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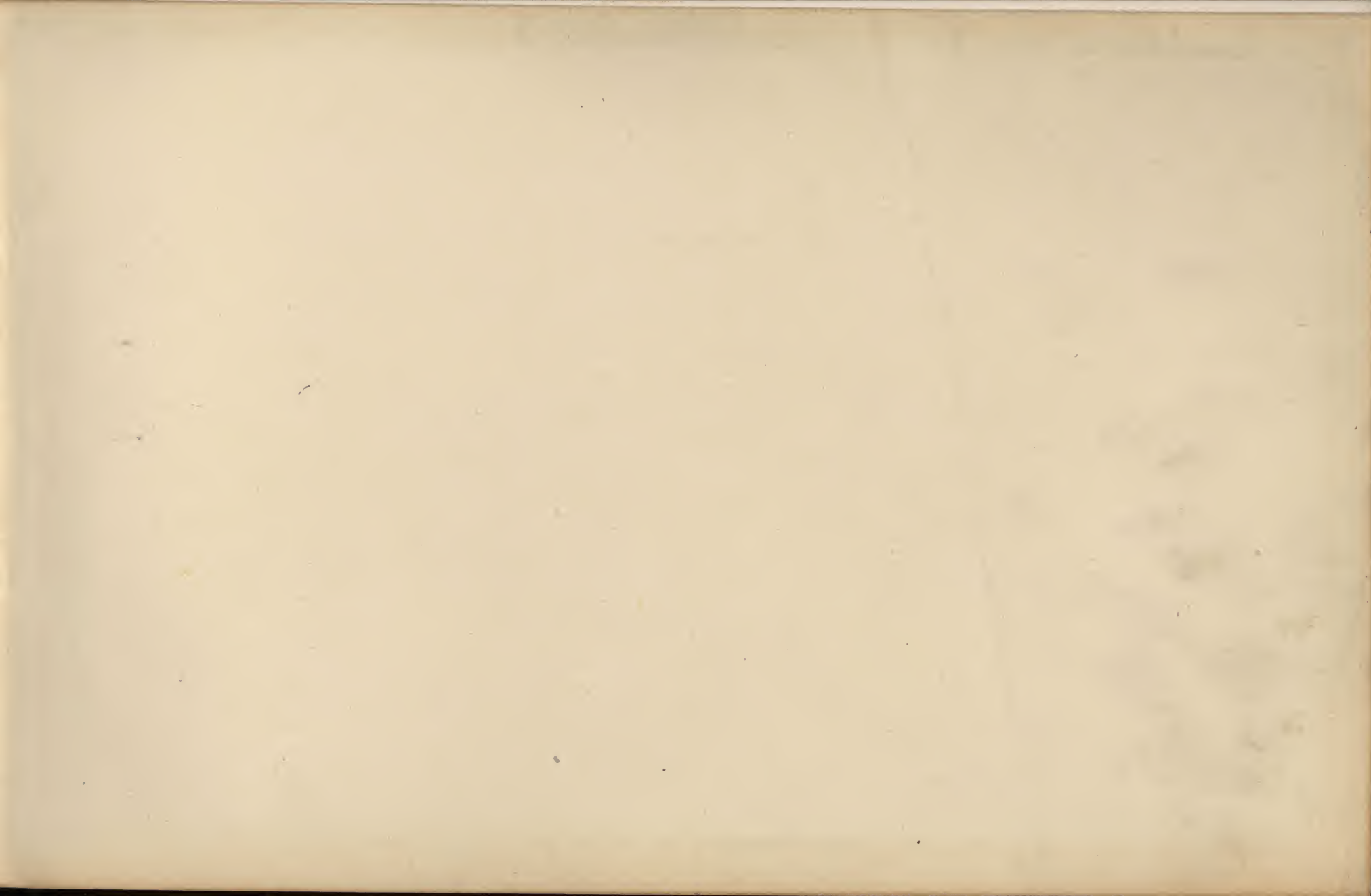
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THIS CATALOGUE CONTAINS
USEFUL INFORMATION AND TABLES RELATIVE TO
IRON, STEEL AND OTHER PRODUCTS
MANUFACTURED BY
MILLIKEN BROTHERS,
NEW YORK CITY, U. S. A.
ARRANGED FOR THE USE OF
ENGINEERS, ARCHITECTS AND BUILDERS.
EXPORT EDITION, OCTOBER, 1899.

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All sections of rolled steel and iron are sold by weight and not by measurement, therefore the sections are liable to vary slightly from the sections as shown in this work.

We are often asked to send out general price lists. In this class of material, where the goods are specially designed for some particular work and the character of the work varies so largely, we find it impossible to make any general price list except for raw material, which is not manufactured. We therefore prefer to quote on each inquiry as received. The prices are subject to change from time to time according to the ruling market rates for raw material; and all quotations are subject to change without notice unless specifically stated in the estimate. All deliveries are contingent on strikes, delays and accidents beyond our control.

PREFACE.

The object of this catalogue is to give to foreign countries, as far as possible, a general idea of what we are able to furnish in the way of iron, steel and other products for buildings, bridges, etc. So far as we know no other parties have ever undertaken to get up such a catalogue, and we trust that this work will meet with general favor.

As you are no doubt aware, the standard of measure in the United States is the English, namely: the inch, foot and yard; and the standard weights are pounds and tons. In nearly all foreign countries the standard of measure and weights is on the French metric system; in this catalogue we have used both forms so that parties can instantly see the two forms of measures and weights. We have also published complete tables so that the equivalents of all measures and weights can be instantly transferred from one system to the other.

It is now a well known fact that the United States of America leads all other countries in the production of iron and steel. It has been evident to our firm for some years back that it was necessary to find an outlet in foreign countries for our manufactured product. For many years back, England, Germany and France have held and controlled the trade of foreign countries in this product. Prices of iron and steel in the United States are much lower than in the above mentioned foreign countries, and in a number of instances we have

been able to successfully compete for delivery of our goods in these countries direct, therefore we feel that by properly presenting the class of goods which we manufacture to foreign countries—that have no idea of the great variety of work that we turn out—we may be able to still further increase our foreign trade, which in the last few years has increased very rapidly. Nearly all foreign countries prefer this class of work to come from the United States for a number of reasons.

In the first place we are able to execute orders much more quickly than our foreign competitors; in other words, we turn out the structural steel work for finished buildings in five or six weeks from date of order, while it takes our competitors as many months to execute a similar order, owing to the effective system that we have for getting out our work.

Our work is all made by template; that is, the piece is first executed in wood and then all similar pieces are made from the same wooden template. This insures accuracy and prevents trouble when work comes to be erected at its destination. This may seem to be a small and unimportant matter to those who have not had experience, but the amount of time wasted and the expense of having to alter work in a foreign country, where facilities are often very limited, is a matter of no small moment.

Our system of marking and shipping the work we believe is also better than that of our foreign competitors. This makes it an easy matter to pick out the pieces and properly assemble the structure after it is received. We feel therefore, that even at even figures, the preference should be given to the manufacturer in the United States.

The tables of sizes, weights, etc., will be found very useful in ordering raw material, and also to engineers in designing their work.

The use of rolled iron for structural purposes has been entirely superseded in this country by the use of rolled steel, which is cheaper to make and for a given strength is much lighter. Parties will please understand therefore that all quotations and estimates are based on the use of steel unless otherwise specially specified.

We can ship from stock almost all of the classes of raw material called for in this catalogue.

Our principal business is the manufacture of all classes of iron, steel and other products that enter into buildings and bridges.

It is almost impossible in this small work to go into the thousand-and-one articles that enter into the construction of, for instance, one of our tall office buildings, and considering all of the other classes of work which we manufacture, if parties do not find in this work any special form of construction or class of material, please remember we can probably make the same and that if you clearly state what is desired we shall be pleased to make sketches, specifications and estimates on receipt of full information.

We have in our main office alone a force of about one hundred engineers and draftsmen who are employed to make these drawings and specifications; and we hope that, if you contemplate ordering any work in our line, you will allow us the privilege of making you a quotation on same.



SHAPES

MANUFACTURED BY

MILLIKEN BROTHERS,

11 BROADWAY,

NEW YORK CITY, U. S. A.

Plate No. 1.

Steel Bars standard sizes.

Round

$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{13}{16}$ "	$\frac{7}{8}$ "	$\frac{15}{16}$ "	1"	$1\frac{1}{16}$ "	$1\frac{1}{8}$ "	$1\frac{3}{16}$ "
9.52,	11.11,	12.69,	14.28,	15.87,	17.46,	19.04,	20.63,	22.22,	23.80,	25.39,	26.98,	28.56,	30.15.
$1\frac{1}{4}$ "	$1\frac{5}{16}$ "	$1\frac{3}{8}$ "	$1\frac{7}{16}$ "	$1\frac{1}{2}$ "	$1\frac{5}{8}$ "	$1\frac{3}{4}$ "	$1\frac{7}{8}$ "	2"	$2\frac{1}{8}$ "	$2\frac{1}{4}$ "			
31.74,	33.32,	34.91,	36.50,	38.09,	41.27,	44.44,	47.62,	50.79,	53.97,	57.14,			
$2\frac{3}{8}$ "	$2\frac{1}{2}$ "	$2\frac{5}{8}$ "	$2\frac{3}{4}$ "	$2\frac{7}{8}$ "	3"	$3\frac{1}{8}$ "	$3\frac{1}{4}$ "	$3\frac{3}{8}$ "	$3\frac{1}{2}$ "				
60.32,	63.49,	66.67,	69.84,	73.02,	76.19,	79.37,	82.54,	85.72,	88.89,				
$3\frac{5}{8}$ "	$3\frac{3}{4}$ "	$3\frac{7}{8}$ "	4"	$4\frac{1}{8}$ "	$4\frac{1}{4}$ "	$4\frac{3}{8}$ "	$4\frac{1}{2}$ "						
92.07,	95.24,	98.42,	101.59,	104.77,	107.94,	111.12,	114.29,						
$4\frac{3}{8}$ "	$4\frac{3}{4}$ "	$4\frac{7}{8}$ "	5"	$5\frac{1}{8}$ "	$5\frac{1}{4}$ "	$5\frac{3}{8}$ "	$5\frac{1}{2}$ "						
117.47,	120.64,	123.82,	126.99,	133.34,	139.69,								
$5\frac{3}{4}$ "	6"	$6\frac{1}{4}$ "	$6\frac{1}{2}$ "	$6\frac{3}{4}$ "									
146.04,	152.39,	158.74,	165.09,	171.44,									

Square

$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{13}{16}$ "	$\frac{7}{8}$ "	$\frac{15}{16}$ "	1"	$1\frac{1}{16}$ "	$1\frac{1}{8}$ "
9.52,	11.11,	12.69,	14.28,	15.87,	17.46,	19.04,	20.63,	22.22,	23.80,	25.39,	26.98,	28.56.
$1\frac{3}{16}$ "	$1\frac{1}{4}$ "	$1\frac{3}{8}$ "	$1\frac{1}{2}$ "	$1\frac{5}{8}$ "	2"	$2\frac{1}{8}$ "	$2\frac{1}{4}$ "	$2\frac{3}{8}$ "	$2\frac{1}{2}$ "			
30.15,	31.74,	34.91,	38.09,	44.44,	50.79,	53.97,	57.14,	60.32,	63.49,			
$2\frac{5}{8}$ "	$2\frac{3}{4}$ "	$2\frac{7}{8}$ "	3"	$3\frac{1}{8}$ "	$3\frac{1}{4}$ "	$3\frac{3}{8}$ "	$3\frac{1}{2}$ "	4"				
66.67,	69.84,	73.02,	76.19,	82.54,	88.89,	95.24,	101.59,					
$4\frac{1}{4}$ "	$4\frac{1}{2}$ "	$4\frac{3}{4}$ "	$4\frac{1}{2}$ "	$4\frac{3}{4}$ "	$5"$							
107.94,	114.29,	120.64,	126.99,									

Halfround

$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{11}{16}$ "	$\frac{3}{4}$ "	$\frac{13}{16}$ "	$\frac{7}{8}$ "
9.52,	11.11,	12.69,	14.28,	15.87,	17.46,	19.04,	20.63,	22.22.
$1\frac{5}{16}$ "	1"	$1\frac{1}{8}$ "	$1\frac{1}{4}$ "	$1\frac{3}{8}$ "	$1\frac{1}{2}$ "			
23.80,	25.39,	28.56,	31.74,	34.91,	38.09,			
$1\frac{5}{8}$ "	$1\frac{3}{4}$ "	2"	$2\frac{1}{4}$ "	$2\frac{1}{2}$ "				
41.27,	44.44,	50.79,	57.14,	63.49,				
3"	$3\frac{1}{2}$ "	4"						
76.19,	88.89,	101.59,						

All dimensions are given in millimetres and inches.

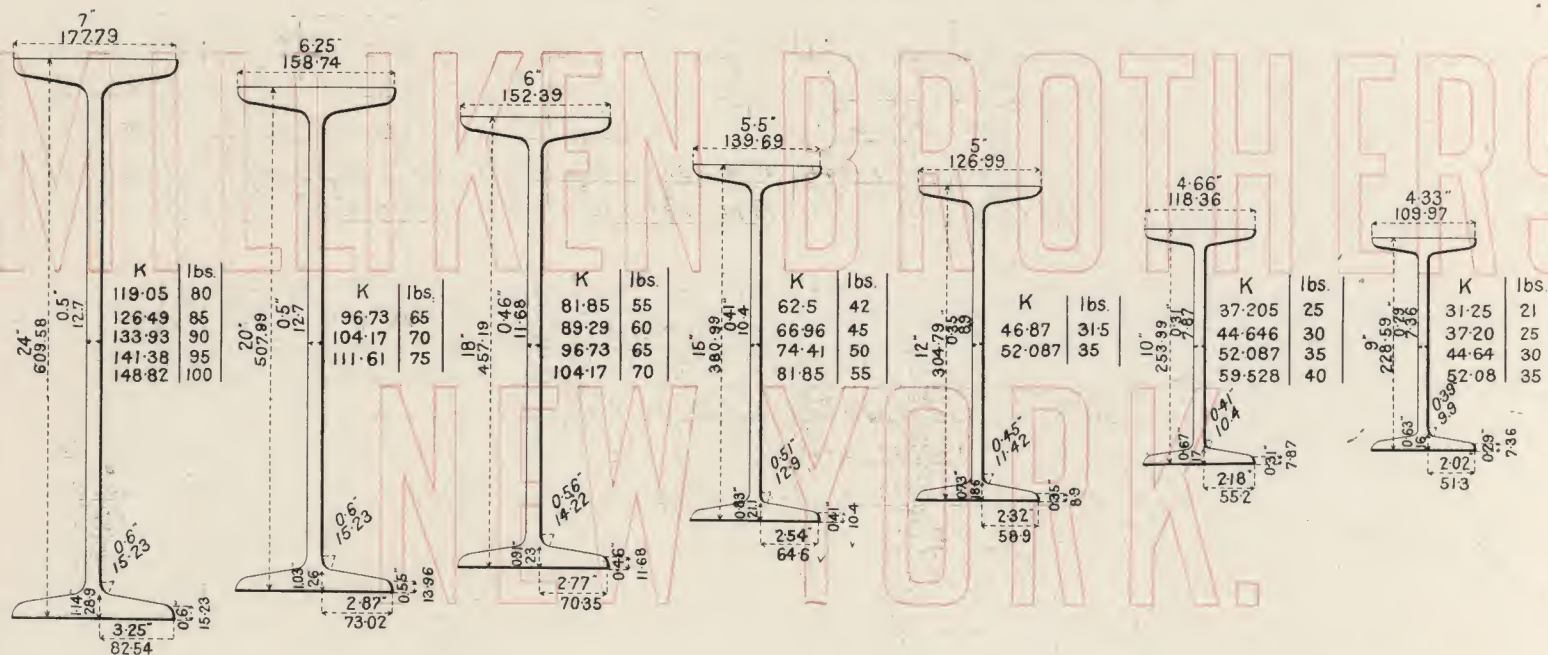
Steel Bars standard sizes.

Flats.

Millimetres and inches.	Width		Thickness.		Width		Thickness.		Width		Thickness.		Width		Thickness.		Width		Thickness.		
	$\frac{5}{8}$ "	$\frac{1}{8}$ "	$\frac{1}{2}$ "	$\frac{1}{8}$ "	$\frac{1}{8}$ "	$\frac{13}{16}$ "	$\frac{1}{8}$ "	$\frac{1}{8}$ "	$2\frac{3}{4}$ "	$\frac{1}{4}$ "	$2\frac{1}{2}$ "	$3\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "	5 "	$\frac{1}{4}$ "	2 "	$6\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "	
	15.87	3.14	12.69	28.56	3.14	25.39	44.44	3.14	41.27	69.84	6.34	63.49	95.24	6.34	50.79	126.99	6.34	50.79	126.99	6.34	50.79
	$\frac{3}{4}$ "	$\frac{1}{8}$ "	$\frac{5}{8}$ "	$\frac{1}{4}$ "	$\frac{1}{8}$ "	1 "	2 "	$\frac{3}{16}$ "	$\frac{1}{8}$ "	3 "	$\frac{1}{4}$ "	$2\frac{3}{4}$ "	4 "	$\frac{1}{4}$ "	2 "	$5\frac{1}{4}$ "	$\frac{1}{4}$ "	2 "	$6\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "
	19.04	3.14	15.87	31.74	3.14	25.39	50.79	4.76	44.44	76.19	6.34	69.84	101.59	6.34	50.79	133.34	6.34	50.79	133.34	6.34	50.79
	$\frac{7}{8}$ "	$\frac{1}{8}$ "	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{8}$ "	$1\frac{1}{4}$ "	$2\frac{1}{4}$ "	$\frac{1}{4}$ "	$1\frac{3}{4}$ "	$3\frac{1}{4}$ "	$\frac{1}{4}$ "	$1\frac{1}{8}$ "	$4\frac{1}{4}$ "	$\frac{1}{4}$ "	2 "	$5\frac{1}{2}$ "	$\frac{1}{4}$ "	2 "	$6\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "
	22.22	3.14	19.04	38.09	3.14	31.74	57.14	6.34	44.44	82.54	6.34	41.27	107.94	6.34	50.79	139.69	6.34	50.79	139.69	6.34	50.79
	1 "	$\frac{1}{8}$ "	$\frac{15}{16}$ "	$\frac{1}{2}$ "	$\frac{1}{8}$ "	$1\frac{1}{2}$ "	$2\frac{1}{2}$ "	$\frac{1}{4}$ "	$2\frac{1}{4}$ "	$3\frac{1}{2}$ "	$\frac{1}{4}$ "	2 "	$4\frac{1}{2}$ "	$\frac{1}{4}$ "	2 "	$5\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "	$6\frac{3}{4}$ "	$\frac{1}{4}$ "	2 "
	25.39	3.14	23.81	41.27	6.34	38.09	63.49	6.34	57.14	88.89	6.34	50.79	114.29	6.34	50.79	146.04	6.34	50.79	146.04	6.34	50.79

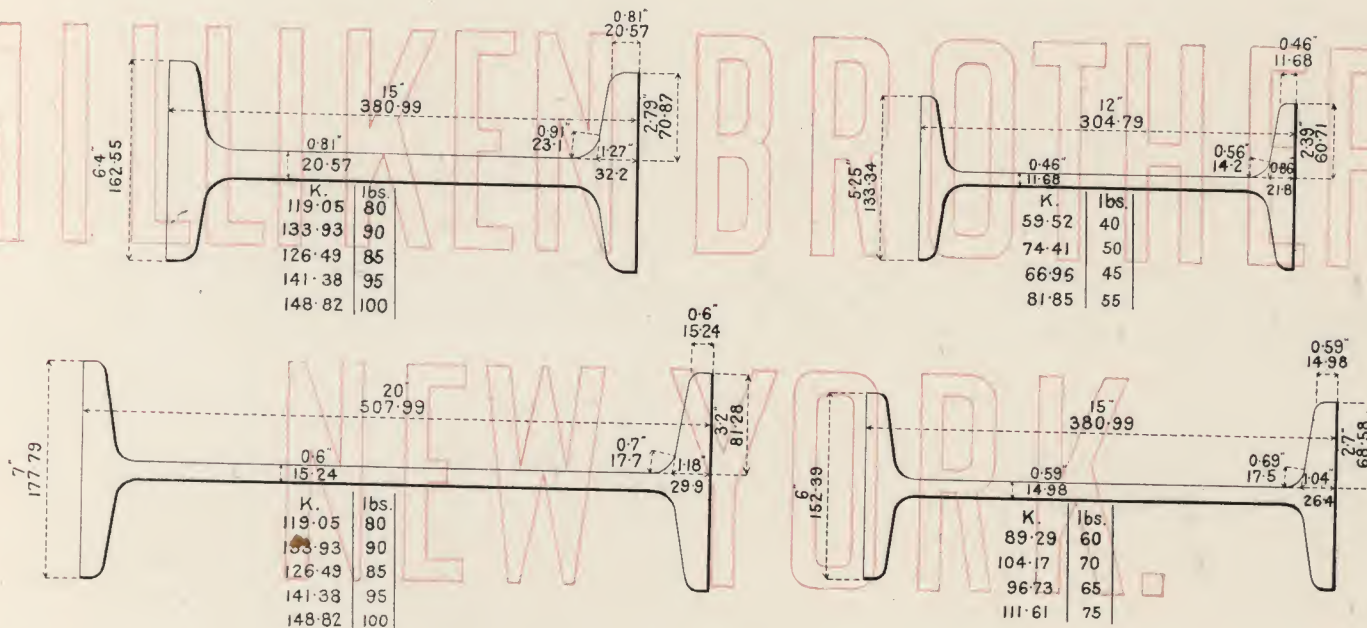
List of extreme sizes of rectangular plates.

Thickness in mm and inches.	Width of plate in millimetres and inches.											
	84"	78"	72"	66"	60"	55"	50"	45"	40"	35"	30"	24"
	2133.5	1981.1	1828.7	1676.3	1523.9	1396.9	1269.9	1142.9	1015.9	888.9	761.9	609.5
	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.	Length in Mand inches.
1"	96"	108"	114"	120"	126"	136"	144"	168"	180"	192"	216"	240"
25.4	2.43836	2.74315	2.89554	3.04794	3.20033	3.45433	3.65753	4.26712	4.57192	4.87671	5.48630	6.09589
$\frac{3}{4}$ "	120"	132"	144"	144"	156"	174"	190"	204"	216"	228"	240"	240"
19.04	3.04794	3.35274	3.65753	3.65753	3.96233	4.41951	4.82591	5.18151	5.48630	5.79110	6.09589	6.09589
$\frac{5}{8}$ "	132"	144"	156"	168"	180"	192"	204"	216"	228"	228"	240"	240"
15.87	3.35274	3.65753	3.96233	4.26712	4.57192	4.87671	5.18151	5.48630	5.79110	5.79110	6.09589	6.09589
$\frac{9}{16}$ "	150"	168"	180"	180"	192"	204"	216"	228"	228"	240"	240"	240"
14.28	3.80992	3.96233	4.26712	4.57192	4.87671	5.18151	5.48630	5.79110	5.79110	6.09589	6.09589	6.09589
$\frac{1}{2}$ "	192"	216"	228"	228"	240"	240"	240"	240"	268"	288"	300"	300"
12.69	4.87671	5.48630	5.79110	5.79110	6.09589	6.09589	6.09589	6.09589	6.80707	7.31507	7.61986	7.61986
$\frac{7}{16}$ "	228"	228"	240"	240"	240"	240"	256"	288"	288"	300"	300"	300"
11.11	5.79110	5.79110	5.79110	6.09589	6.09589	6.09589	6.09589	6.50227	7.31507	7.61986	7.61986	7.61986
$\frac{3}{8}$ "	228"	236"	240"	250"	260"	260"	274"	288"	300"	300"	300"	300"
9.52	5.79110	5.99429	6.09589	6.34988	6.60387	6.60387	6.95947	7.31507	7.61986	7.61986	7.61986	7.61986
$\frac{5}{16}$ "	204"	240"	250"	260"	276"	274"	288"	288"	300"	300"	300"	300"
7.93	5.18151	6.09589	6.34988	6.60387	7.01027	6.95947	7.31507	7.31507	7.61986	7.61986	7.61986	7.61986
$\frac{1}{4}$ "	192"	192"	204"	204"	204"	216"	288"	288"	300"	300"	300"	300"
6.34	4.87671	4.87671	5.18151	5.18151	5.18151	5.48630	7.31507	7.31507	7.61986	7.61986	7.61986	7.61986



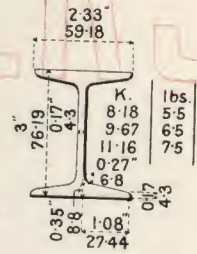
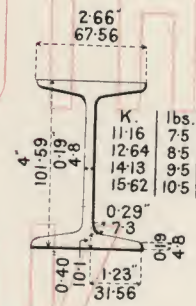
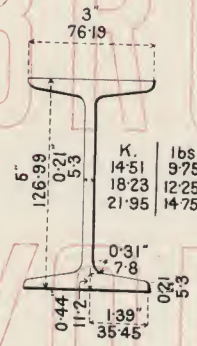
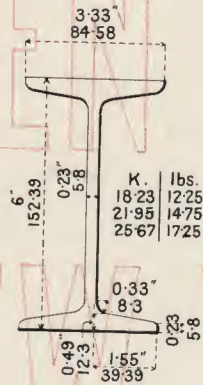
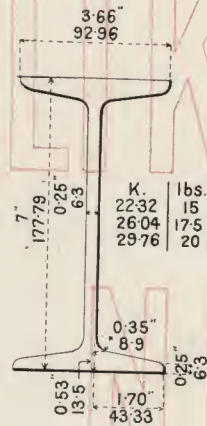
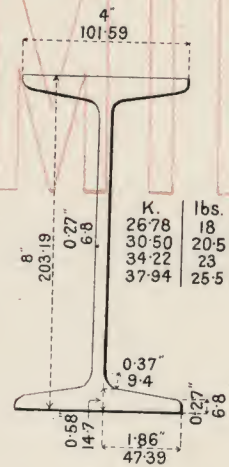
All dimensions given are for minimum weight of each section.

Steel Beams, standard sections.



*All dimensions are given in millimetres, and inches.
All weights are given in kilograms per metre, and pounds per lineal foot.
All dimensions given are for minimum weight of each section.*

Steel Beams, standard sections.



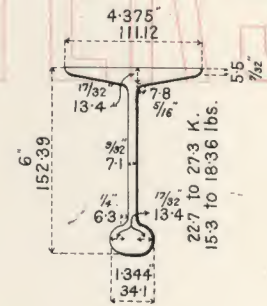
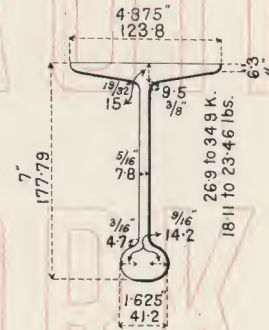
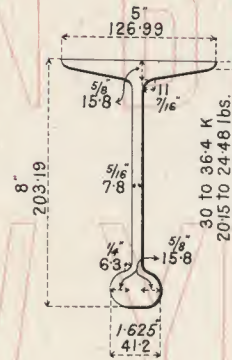
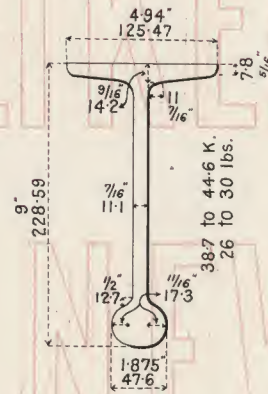
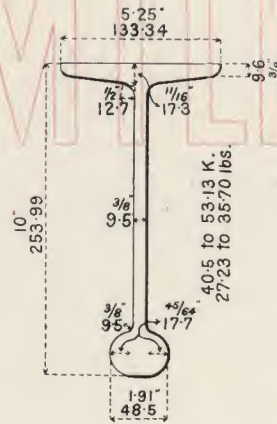
All dimensions are given in millimetres and inches.
All weights are given in kilograms per metre and pounds per lineal foot
All dimensions given are for minimum weight of each section

Plate No. 6.

Maximum, intermediate and minimum weights and dimensions of steel Beams, standard sections.

Depth of beam m.m.	Depth of beam inches.	Weight per M. Kilogramme.	Weight per ft. lbs.	Width of flange m.m.	Width of flange inches	Thickness of web m.m.	Thickness of web inches.	Depth of beam m.m.	Depth of beam inches.	Weight per M. Kilogramme.	Weight per ft. lbs.	Width of flange m.m.	Width of flange inches	Thickness of web m.m.	Thickness of web inches.
609.58	24	148.82	100	184.14	7.254	19.1	0.754	304.79	12	81.85	55	142.54	5.612	20.8	0.822
		141.38	95	182.62	7.192	17.5	0.692			74.41	50	139.40	5.489	17.7	0.699
		133.93	90	181.09	7.131	16.0	0.631			66.96	45	136.29	5.366	14.6	0.576
		126.49	85	179.57	7.070	14.4	0.570			59.52	40	133.34	5.250	11.6	0.460
507.99	20	119.05	80	177.79	7.000	12.7	0.500	253.99	10	59.52	40	129.53	5.099	19.0	0.749
		148.82	100	185.00	7.284	22.4	0.884			52.08	35	125.77	4.952	15.2	0.602
		141.38	95	183.13	7.210	20.5	0.810			44.64	30	122.03	4.805	11.5	0.455
		133.93	90	181.26	7.137	18.7	0.737			37.20	25	118.36	4.660	7.8	0.310
457.19	18	126.49	85	179.39	7.063	16.8	0.663	203.19	8	52.08	35	121.20	4.772	18.6	0.732
		119.05	80	177.79	7.000	15.2	0.600			44.64	30	117.05	4.609	14.4	0.569
		111.61	75	162.55	6.399	16.5	0.649			37.20	25	112.95	4.446	10.3	0.406
		104.17	70	160.65	6.325	14.6	0.575			31.25	21	109.97	4.330	7.3	0.290
380.99	15	96.73	65	158.74	6.250	12.7	0.500	177.79	7	37.94	25.5	108.48	4.271	13.7	0.541
		104.17	70	158.96	6.259	18.2	0.719			34.22	23	106.13	4.179	11.4	0.449
		96.73	65	156.88	6.177	16.1	0.637			30.50	20.5	103.79	4.087	9.0	0.357
		89.29	60	154.80	6.095	14.0	0.555			26.78	18	101.59	4.000	6.8	0.270
304.79	12	81.85	55	152.39	6.000	11.6	0.460	152.39	6	29.76	20	98.24	3.868	11.6	0.458
		148.82	100	172.05	6.774	30.0	1.184			26.04	17.5	95.57	3.763	8.9	0.353
		141.38	95	169.53	6.675	27.5	1.085			22.32	15	92.96	3.660	6.3	0.250
		133.93	90	167.04	6.577	25.0	0.987			25.67	17.25	90.80	3.575	12.0	0.475
304.79	12	126.49	85	164.55	6.479	22.5	0.889	126.99	5	21.95	14.75	87.67	3.452	8.9	0.352
		119.05	80	162.55	6.400	20.5	0.810			18.23	12.25	84.58	3.330	5.8	0.230
		111.61	75	159.81	6.292	22.4	0.882			21.95	14.75	83.66	3.294	12.8	0.504
		104.17	70	157.32	6.194	19.9	0.784			18.23	12.25	79.92	3.147	9.0	0.357
304.79	12	96.73	65	154.83	6.096	17.4	0.686	101.59	4	14.51	9.75	76.19	3.000	5.3	0.210
		89.29	60	152.39	6.000	14.9	0.590			15.62	10.5	73.15	2.880	10.4	0.410
		81.85	55	145.94	5.746	16.6	0.656			14.13	9.5	71.30	2.807	8.5	0.337
		74.41	50	143.45	5.648	14.1	0.558			12.64	8.5	69.41	2.733	6.6	0.263
304.79	12	66.96	45	140.96	5.550	11.6	0.460	76.19	3	11.16	7.5	67.56	2.660	4.8	0.190
		62.50	42	139.69	5.500	10.4	0.410			11.16	7.5	64.02	2.521	9.1	0.361
		52.08	35	129.18	5.086	11.1	0.436			9.67	6.5	61.53	2.423	6.6	0.263
		46.87	31.5	126.96	5.000	8.9	0.350			8.18	5.5	59.18	2.330	4.3	0.170

Steel Deck Beams, standard sections.

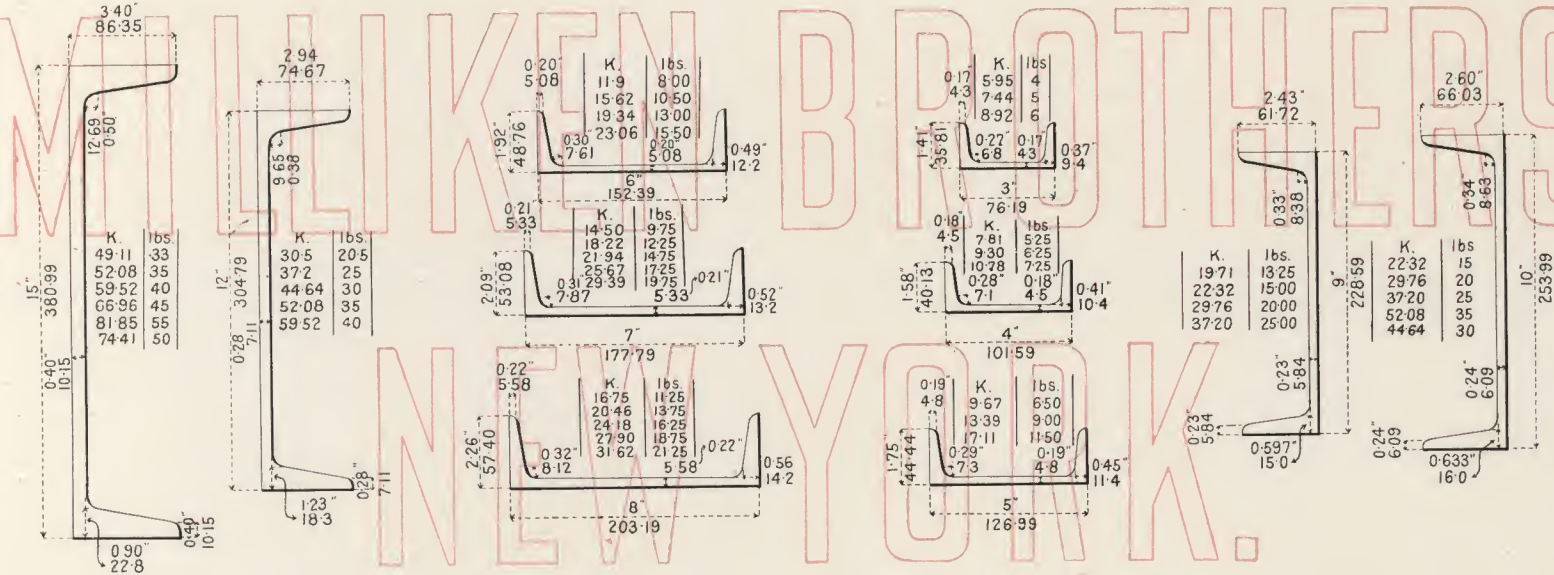


All dimensions are given in millimetres and inches.

All weights are given in kilograms per metre and pounds per lineal foot.

All dimensions given are for minimum weight of each section.

Steel Channels, standard sections.



All dimensions are given in millimetres and inches.
 All weights are given in kilograms per metre and pounds per lineal foot.
 All dimensions given are for minimum weight of each section.

Plate No. 9.

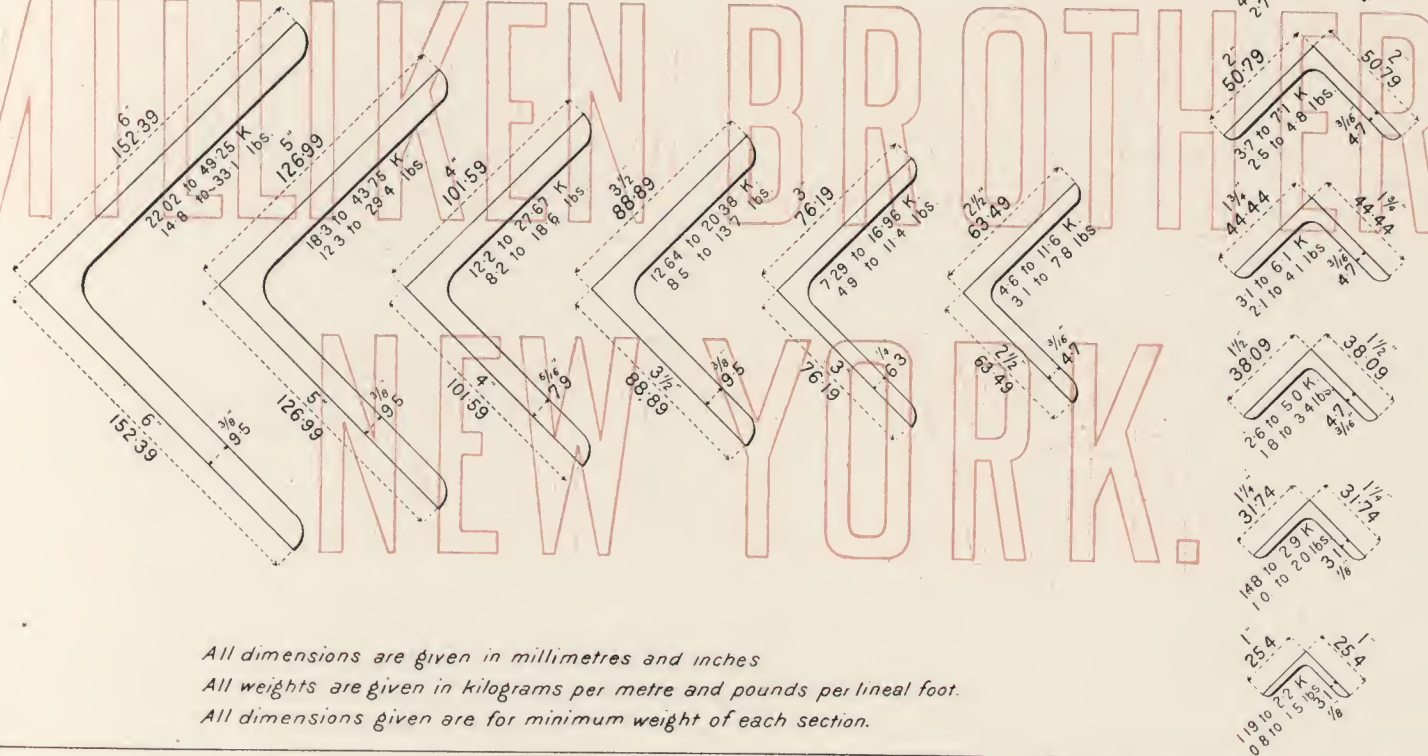
Maximum and minimum weights and dimensions of steel Deck Beams, standard sections.

Depth of beam m.m.	Depth of beam inches.	Weight per M. kilograms.		Weight per ft. lbs.		Width of flange m.m.		Width of flange inches.		Thickness of web m.m.		Thickness of web inches.	
		minimum.	maximum.	minimum.	maximum.	minimum.	maximum.	minimum.	maximum.	minimum.	maximum.	minimum.	maximum.
253·99	10	40·5	53·13	27·23	35·70	133·34	139·69	5·25	5·50	9·6	16·0	·38	·63
228·59	9	38·7	44·6	26·00	30·00	125·47	128·77	4·94	5·07	11·1	14·4	·44	·57
203·19	8	30·0	36·4	20·15	24·48	126·99	131·06	5·00	5·16	7·8	11·9	·31	·47
177·79	7	26·9	34·9	18·11	23·46	123·80	129·53	4·87	5·10	7·8	13·7	·31	·54
152·39	6	22·7	27·3	15·30	18·36	111·12	115·05	4·38	4·53	7·1	10·9	·28	·43

Maximum, intermediate and minimum weights and dimensions of steel Channels, standard sections.

Depth of Channel m.m.	Depth of Channel ins.	Weight per M. Kilograms.	Weight per ft. lbs.	Width of flange m.m.	Width of flange inches.	Thickness of web m.m.	Thickness of web ins.	Depth of Channel m.m.	Depth of Channel ins.	Weight per M. Kilograms.	Weight per ft. lbs.	Width of flange m.m.	Width of flange inches.	Thickness of web m.m.	Thickness of web ins.
380·99	15	81·85	55·00	96·97	3·818	20·77	0·818	203·19	8	24·18	16·25	61·97	2·439	10·15	0·399
380·99	15	74·41	50·00	94·48	3·720	18·28	0·720	203·19	8	20·46	13·75	59·61	2·347	7·87	0·307
380·99	15	66·96	45·00	91·99	3·622	15·79	0·622	203·19	8	16·74	11·25	57·40	2·260	5·58	0·220
380·99	15	59·52	40·00	89·50	3·524	13·30	0·524	177·79	7	29·39	19·75	63·82	2·513	16·07	0·633
380·99	15	52·08	35·00	87·01	3·426	10·81	0·426	177·79	7	25·67	17·25	61·21	2·408	13·46	0·528
380·99	15	49·11	33·00	86·35	3·400	10·15	0·400	177·79	7	21·95	14·75	58·49	2·303	10·67	0·423
304·79	12	59·52	40·00	86·81	3·418	19·24	0·758	177·79	7	18·23	12·25	55·87	2·198	8·12	0·318
304·79	12	52·08	35·00	83·71	3·296	16·15	0·636	177·79	7	14·50	9·75	53·08	2·090	5·33	0·210
304·79	12	44·64	30·00	80·58	3·173	13·02	0·513	152·39	6	23·06	15·50	57·98	2·283	14·22	0·563
304·79	12	37·20	25·00	77·46	3·050	9·90	0·390	152·39	6	19·34	13·00	54·86	2·160	11·17	0·440
304·79	12	30·50	20·50	74·67	2·940	7·11	0·280	152·39	6	15·62	10·50	51·81	2·038	8·12	0·318
253·99	10	52·08	35·00	80·84	3·183	20·90	0·823	152·39	6	11·90	8·00	48·76	1·920	5·07	0·200
253·99	10	44·64	30·00	77·12	3·036	17·17	0·676	126·99	5	17·11	11·50	51·81	2·037	12·19	0·477
253·99	10	37·20	25·00	73·40	2·889	13·46	0·529	126·99	5	13·39	9·00	48·00	1·890	8·38	0·330
253·99	10	29·76	20·00	69·64	2·742	9·65	0·382	126·99	5	9·67	6·50	44·44	1·750	4·82	0·190
253·99	10	22·32	15·00	66·03	2·600	6·09	0·240	101·59	4	10·78	7·25	43·81	1·725	8·38	0·325
228·59	9	37·20	25·00	71·49	2·815	15·74	0·615	101·59	4	9·30	6·25	41·27	1·625	6·34	0·252
228·59	9	29·76	20·00	67·35	2·652	11·42	0·452	101·59	4	7·81	5·25	40·13	1·580	4·57	0·180
228·59	9	22·32	15·00	63·24	2·488	7·36	0·288	76·19	3	8·92	6·00	40·68	1·602	9·14	0·362
228·59	9	19·71	13·25	61·72	2·430	5·80	0·230	76·19	3	7·44	5·00	38·19	1·504	6·60	0·264
203·19	8	31·62	21·25	66·54	2·622	14·73	0·582	76·19	3	5·95	4·00	35·81	1·410	4·31	0·170
203·19	8	27·90	18·75	64·26	2·530	12·44	0·490								

Steel Angles, equal legs, standard sections.



All dimensions are given in millimetres and inches
 All weights are given in kilograms per metre and pounds per lineal foot.
 All dimensions given are for minimum weight of each section.

Plate No. 11.

Maximum intermediate and minimum weights and dimensions of steel Angles of standard sections.

Equal legs.

Thickness mm	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms	Weight per ft. lbs.
9.5	$\frac{3}{8}$	152.39x152.39	6x6	2202	148	7.9	$\frac{5}{16}$	101.59x101.59	4x4	1220	82	4.7	$\frac{1}{8}$	63.49x63.49	2½x2½	460	31	4.7	$\frac{1}{8}$	38.09x38.09	1½x1½	267	18
11.17	$\frac{7}{16}$	152.39x152.39	6x6	2559	172	9.5	$\frac{3}{8}$	101.59x101.59	4x4	1458	98	6.3	$\frac{1}{4}$	63.49x63.49	2½x2½	610	41	6.3	$\frac{1}{4}$	38.09x38.09	1½x1½	357	24
12.70	$\frac{1}{2}$	152.39x152.39	6x6	2916	196	11.17	$\frac{7}{16}$	101.59x101.59	4x4	1681	113	7.9	$\frac{1}{2}$	63.49x63.49	2½x2½	744	50	7.9	$\frac{1}{2}$	38.09x38.09	1½x1½	431	29
14.22	$\frac{9}{16}$	152.39x152.39	6x6	3259	219	12.70	$\frac{1}{2}$	101.59x101.59	4x4	1904	128	9.5	$\frac{3}{8}$	63.49x63.49	2½x2½	878	59	9.5	$\frac{3}{8}$	38.09x38.09	1½x1½	505	34
16.00	$\frac{5}{8}$	152.39x152.39	6x6	3601	242	14.22	$\frac{9}{16}$	101.59x101.59	4x4	2128	143	11.17	$\frac{1}{2}$	63.49x63.49	2½x2½	1026	68						
17.52	$\frac{11}{16}$	152.39x152.39	6x6	3943	265	16.00	$\frac{5}{8}$	101.59x101.59	4x4	2336	157	12.70	$\frac{1}{2}$	63.49x63.49	2½x2½	1160	77						
19.04	$\frac{3}{4}$	152.39x152.39	6x6	4271	287	17.52	$\frac{11}{16}$	101.59x101.59	4x4	2544	171												
20.57	$\frac{13}{16}$	152.39x152.39	6x6	4598	309	19.04	$\frac{3}{4}$	101.59x101.59	4x4	2767	185												
22.35	$\frac{7}{8}$	152.39x152.39	6x6	4925	331							4.7	$\frac{1}{8}$	57.14x57.14	2¼x2¼	401	28						
						9.5	$\frac{5}{16}$	88.89x88.89	3½x3½	1264	85	6.3	$\frac{1}{4}$	57.14x57.14	2¼x2¼	535	36						
						11.17	$\frac{7}{16}$	88.89x88.89	3½x3½	1458	98	7.9	$\frac{1}{2}$	57.14x57.14	2¼x2¼	669	45	3.1	$\frac{1}{8}$	31.74x31.74	1¼x1¼	148	10
						12.70	$\frac{1}{2}$	88.89x88.89	3½x3½	1651	111	9.5	$\frac{3}{8}$	57.14x57.14	2¼x2¼	803	54	4.7	$\frac{1}{4}$	31.74x31.74	1¼x1¼	223	15
9.5	$\frac{3}{8}$	126.99x126.99	5x5	1830	123	14.22	$\frac{9}{16}$	88.89x88.89	3½x3½	1830	123							6.3	$\frac{1}{4}$	31.74x31.74	1¼x1¼	290	19
11.17	$\frac{7}{16}$	126.99x126.99	5x5	2128	143	16.00	$\frac{5}{8}$	88.89x88.89	3½x3½	2038	136	4.7	$\frac{1}{8}$	50.79x50.79	2x2	370	25						
12.70	$\frac{1}{2}$	126.99x126.99	5x5	2410	162							6.3	$\frac{1}{4}$	50.79x50.79	2x2	476	32						
14.22	$\frac{9}{16}$	126.99x126.99	5x5	2693	181	6.3	$\frac{1}{4}$	76.19x76.19	3x3	729	49	7.9	$\frac{1}{2}$	50.79x50.79	2x2	595	40						
16.00	$\frac{5}{8}$	126.99x126.99	5x5	2991	200	7.9	$\frac{3}{8}$	76.19x76.19	3x3	907	61	9.5	$\frac{1}{2}$	50.79x50.79	2x2	714	48						
17.52	$\frac{11}{16}$	126.99x126.99	5x5	3274	218	9.5	$\frac{1}{2}$	76.19x76.19	3x3	1071	72												
19.04	$\frac{3}{4}$	126.99x126.99	5x5	3541	236	11.17	$\frac{7}{16}$	76.19x76.19	3x3	1235	83	4.7	$\frac{1}{8}$	44.44x44.44	1¾x1¾	312	21						
20.57	$\frac{13}{16}$	126.99x126.99	5x5	3809	254	12.70	$\frac{1}{2}$	76.19x76.19	3x3	1398	94	6.3	$\frac{1}{4}$	44.44x44.44	1¾x1¾	416	28	3.1	$\frac{1}{8}$	25.4x25.4	1x1	119	08
22.35	$\frac{7}{8}$	126.99x126.99	5x5	4077	272	14.22	$\frac{9}{16}$	76.19x76.19	3x3	1547	104	7.9	$\frac{1}{2}$	44.44x44.44	1¾x1¾	505	34	4.7	$\frac{1}{4}$	25.4x25.4	1x1	178	12
23.87	$\frac{15}{16}$	126.99x126.99	5x5	4375	294	16.00	$\frac{5}{8}$	76.19x76.19	3x3	1696	114	9.5	$\frac{3}{8}$	44.44x44.44	1¾x1¾	610	41	6.3	$\frac{1}{4}$	25.4x25.4	1x1	223	15

Steel Angles, unequal legs, standard sections.

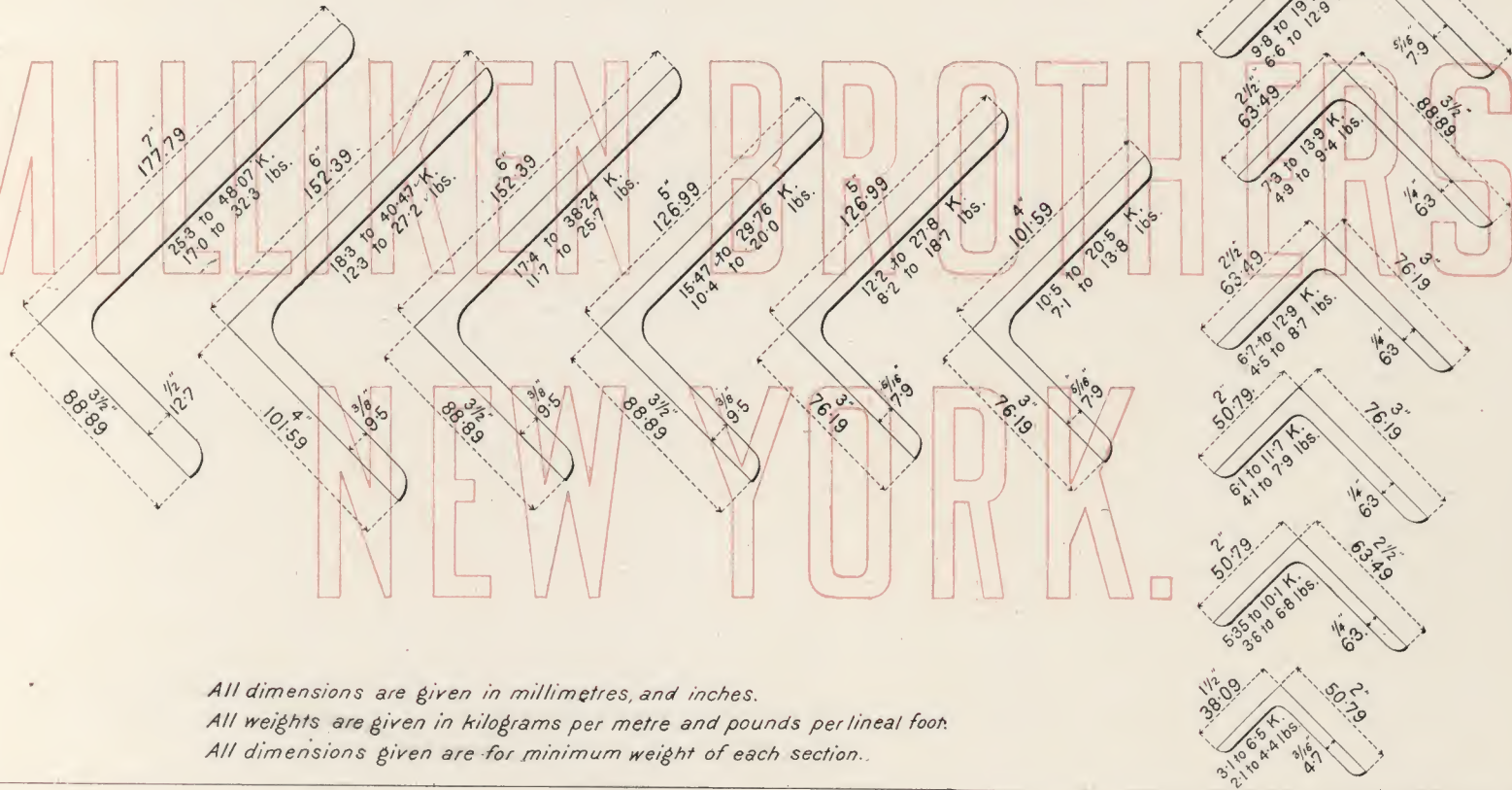
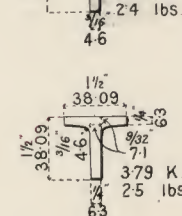
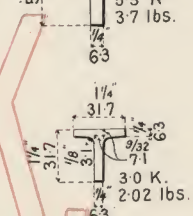
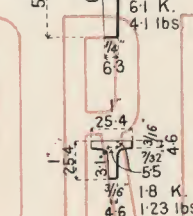
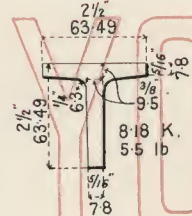
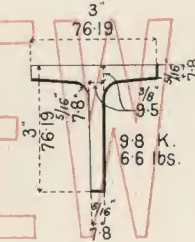
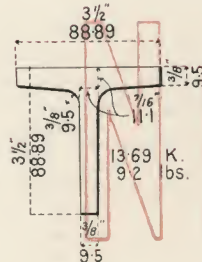
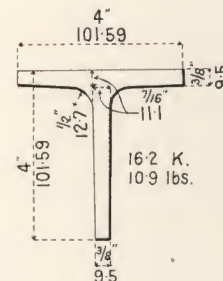
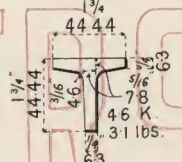
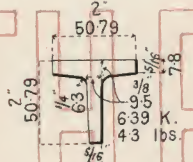
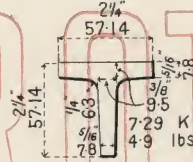
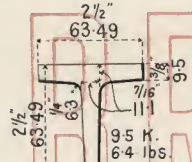
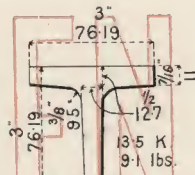
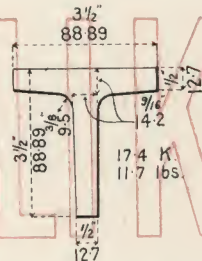
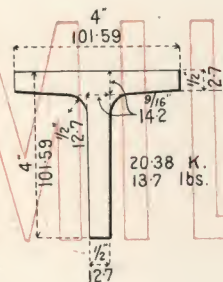


Plate No. 13.

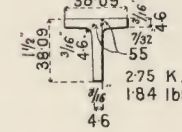
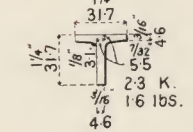
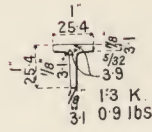
*Maximum, intermediate and minimum weights and dimensions of steel Angles of standard sections.
Unequal legs.*

Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms.	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms.	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms.	Weight per ft. lbs.	Thickness mm.	Thickness ins.	Size m.m.	Size ins.	Weight per M. Kilograms.	Weight per ft. lbs.
12.7	1/2	177.79x88.89	7x3 1/2	2530	170	12.70	1/2	152.39x88.89	6x3 1/2	2276	153	17.52	11/16	126.99x76.19	5x3	2544	171	63	1/4	76.19x50.79	3x2	610	41
14.22	9/16	177.79x88.89	7x3 1/2	2827	190	14.22	9/16	152.39x88.89	6x3 1/2	2544	171	19.04	3/4	126.99x76.19	5x3	2782	185	79	5/16	76.19x50.79	3x2	744	50
16.00	5/8	177.79x88.89	7x3 1/2	3125	210	16.00	5/8	152.39x88.89	6x3 1/2	2812	189							95	3/8	76.19x50.79	3x2	878	59
17.52	11/16	177.79x88.89	7x3 1/2	3422	230	17.52	11/16	152.39x88.89	6x3 1/2	3065	206	7.9	5/8	101.59x76.19	4x3	1056	71	11.17	11/16	76.19x50.79	3x2	1011	68
19.04	3/4	177.79x88.89	7x3 1/2	3690	249	19.04	3/4	152.39x88.89	6x3 1/2	3318	223	9.5	3/8	101.59x76.19	4x3	1264	85	12.70	1/2	76.19x50.79	3x2	117	77
20.57	13/16	177.79x88.89	7x3 1/2	3973	268	20.57	13/16	152.39x88.89	6x3 1/2	3571	240	11.17	11/16	101.59x76.19	4x3	1458	98						
22.35	7/8	177.79x88.89	7x3 1/2	4256	287	22.35	7/8	152.39x88.89	6x3 1/2	3824	257	12.70	1/2	101.59x76.19	4x3	1651	111	63	1/4	76.19x63.49	3x2 1/2	67	45
23.80	15/16	177.79x88.89	7x3 1/2	4539	305							14.22	9/16	101.59x76.19	4x3	1830	123	79	5/16	76.19x63.49	3x2 1/2	818	55
25.40	1	177.79x88.89	7x3 1/2	4807	323	9.5	3/8	126.99x88.89	5x3 1/2	1547	104	16.00	5/8	101.59x76.19	4x3	2050	136	95	3/8	76.19x63.49	3x2 1/2	982	66
						11.17	11/16	126.99x88.89	5x3 1/2	1785	120							11.17	11/16	76.19x63.49	3x2 1/2	1145	76
9.5	3/8	152.39x101.59	6x4	183	123	12.70	1/2	126.99x88.89	5x3 1/2	2023	136	7.9	5/8	88.89x76.19	3 1/2x3	98	66	12.70	1/2	76.19x63.49	3x2 1/2	129	85
11.17	7/16	152.39x101.59	6x4	2128	143	14.22	9/16	126.99x88.89	5x3 1/2	2263	152	9.5	3/8	88.89x76.19	3 1/2x3	1160	78						
12.70	1/2	152.39x101.59	6x4	2425	162	16.00	5/8	126.99x88.89	5x3 1/2	2500	168	11.17	11/16	88.89x76.19	3 1/2x3	1354	91	63	1/4	63.49x50.79	2 1/2x2	535	36
14.22	9/16	152.39x101.59	6x4	2693	181	17.52	11/16	126.99x88.89	5x3 1/2	2723	183	12.70	1/2	88.89x76.19	3 1/2x3	1532	102	79	5/16	63.49x50.79	2 1/2x2	669	45
16.00	5/8	152.39x101.59	6x4	2976	200	19.04	3/4	126.99x88.89	5x3 1/2	2976	198	14.22	9/16	88.89x76.19	3 1/2x3	1696	114	95	3/8	63.49x50.79	2 1/2x2	803	53
17.52	11/16	152.39x101.59	6x4	3274	218							16.00	5/8	88.89x76.19	3 1/2x3	1920	129	11.17	11/16	63.49x50.79	2 1/2x2	922	61
19.04	3/4	152.39x101.59	6x4	3541	236	7.9	5/8	126.99x76.19	5x3	122	82							12.70	1/2	63.49x50.79	2 1/2x2	101	68
20.57	13/16	152.39x101.59	6x4	3809	254	9.5	3/8	126.99x76.19	5x3	1443	97	63	1/4	88.89x63.49	3 1/2x2 1/2	729	49						
22.35	7/8	152.39x101.59	6x4	4047	272	11.17	11/16	126.99x76.19	5x3	1666	113	7.9	5/16	88.89x63.49	3 1/2x2 1/2	907	61	47	3/16	50.79x38.09	2x1 1/2	312	21
						12.70	1/2	126.99x76.19	5x3	1904	128	9.5	3/8	88.89x63.49	3 1/2x2 1/2	1072	72	63	1/4	50.79x38.09	2x1 1/2	431	29
9.5	3/8	152.39x88.89	6x3 1/2	1740	117	14.22	9/16	126.99x76.19	5x3	2113	142	11.17	11/16	88.89x63.49	3 1/2x2 1/2	1235	83	79	5/16	50.79x38.09	2x1 1/2	535	36
11.17	7/16	152.39x88.89	6x3 1/2	2009	135	16.00	5/8	126.99x76.19	5x3	2336	157	12.70	1/2	88.89x63.49	3 1/2x2 1/2	1398	94	95	3/8	50.79x38.09	2x1 1/2	650	44

*Steel Tees, standard sections.
Equal legs.*



*All dimensions are given in millimetres and inches.
All weights are given in kilograms per metre and pounds per lineal foot.*



*Steel Tees, standard sections.
Unequal legs.*

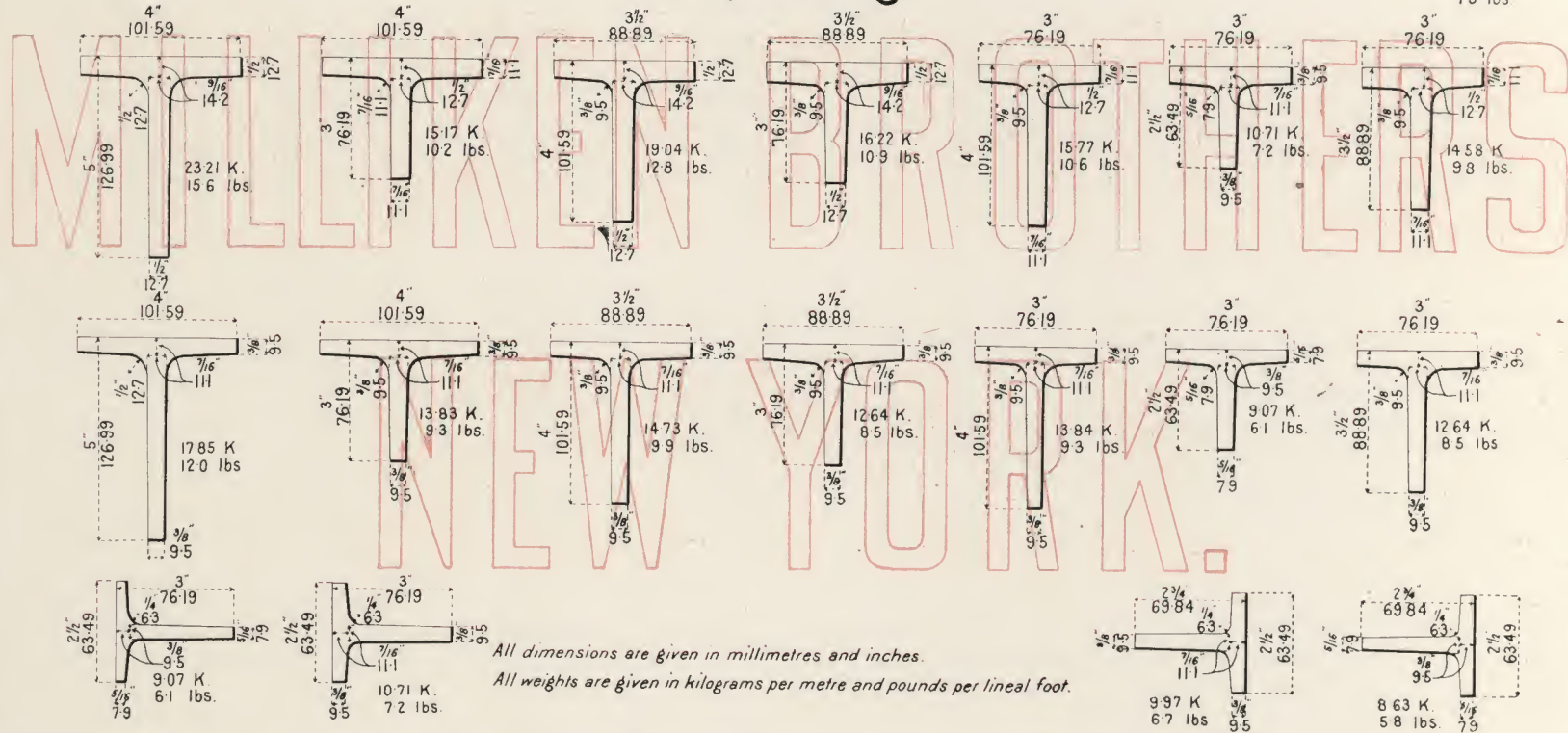
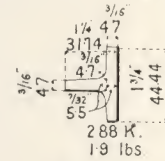
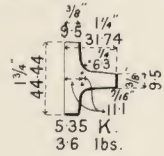


Plate No. 16.

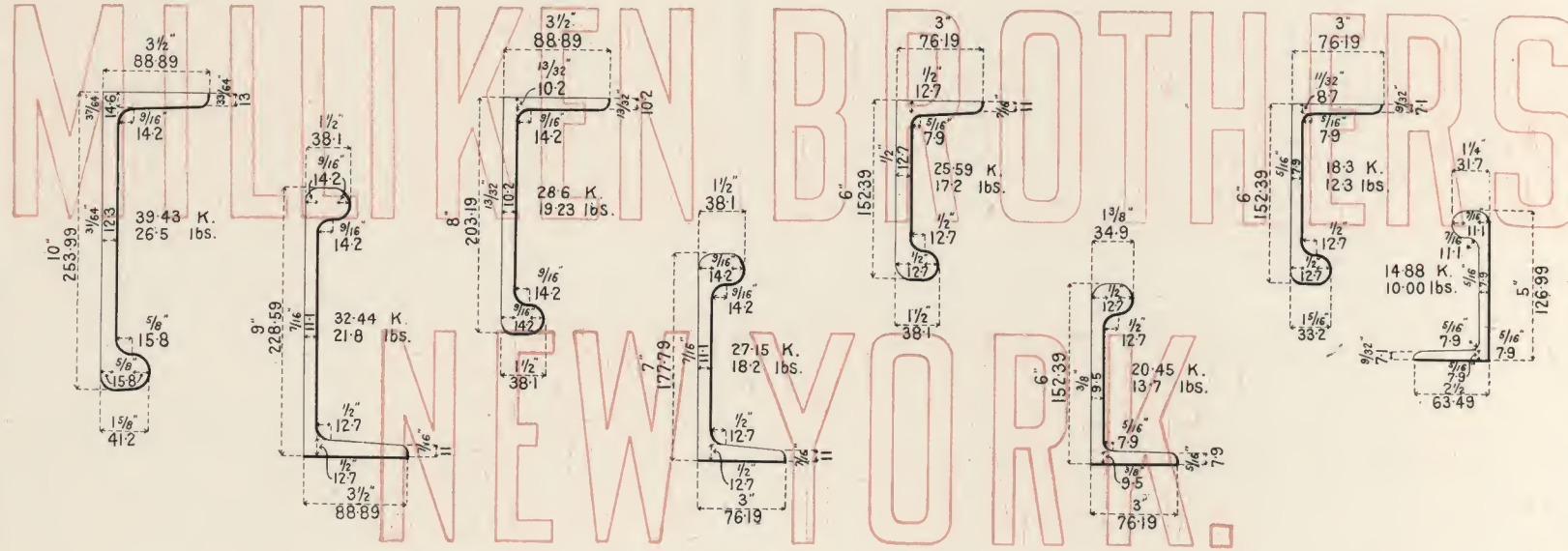
Weights and dimensions of steel Tees standard sections. Equal legs.

Size in m.m.		Size in ins.		Thickness	Thickness	Weight per M.	Weight per ft.	Size in m.m.		Size in ins.		Thickness	Thickness	Weight per M.	Weight per ft.
Flange.	Stem.	Flange.	Stem.	m.m.	ins.	Kilograms.	lbs.	Flange.	Stem.	Flange.	Stem.	m.m.	ins.	Kilograms.	lbs.
101.59	101.59	4	4	127 to 142	1/2 to 5/16	20.38	13.7	50.79	50.79	2	2	78 to 95	5/16 to 3/8	6.39	4.3
101.59	101.59	4	4	95 to 111	3/8 to 7/16	16.20	10.9	50.79	50.79	2	2	63 to 78	1/4 to 5/16	5.5	3.8
88.89	88.89	3 1/2	3 1/2	127 to 142	1/2 to 5/16	17.40	11.7	44.44	44.44	1 3/4	1 3/4	63 to 78	1/4 to 5/16	4.60	3.1
88.89	88.89	3 1/2	3 1/2	95 to 111	3/8 to 7/16	13.69	9.2	44.44	44.44	1 3/4	1 3/4	46 to 63	3/16 to 1/4	3.57	2.4
76.19	76.19	3	3	111 to 127	5/16 to 1/2	13.50	9.1	38.09	38.09	1 1/2	1 1/2	63 to 71	1/4 to 5/32	3.79	2.5
76.19	76.19	3	3	78 to 95	5/16 to 3/8	9.80	6.6	38.09	38.09	1 1/2	1 1/2	46 to 55	3/16 to 3/32	2.87	1.9
63.49	63.49	2 1/2	2 1/2	95 to 111	3/8 to 7/16	9.50	6.4	31.7	31.7	1 1/4	1 1/4	63 to 71	1/4 to 5/32	3.0	2.0
63.49	63.49	2 1/2	2 1/2	78 to 95	5/16 to 3/8	8.18	5.5	31.7	31.7	1 1/4	1 1/4	46 to 55	3/16 to 3/32	2.3	1.6
57.14	57.14	2 1/4	2 1/4	78 to 95	5/16 to 3/8	7.29	4.9	25.4	25.4	1	1	46 to 55	3/16 to 3/32	1.8	1.2
57.14	57.14	2 1/4	2 1/4	63 to 78	1/4 to 5/16	6.10	4.1	25.4	25.4	1	1	31 to 39	1/8 to 5/32	1.3	0.9

Weights and dimensions of steel Tees standard sections. Unequal legs.

Size in m.m.		Size in ins.		Thickness	Thickness	Weight per M.	Weight per ft.	Size in m.m.		Size in ins.		Thickness	Thickness	Weight per M.	Weight per ft.
Flange.	Stem.	Flange.	Stem.	m.m.	ins.	Kilograms.	lbs.	Flange.	Stem.	Flange.	Stem.	m.m.	ins.	Kilograms.	lbs.
101.59	126.99	4	5	127 to 142	1/2 to 5/16	23.21	15.6	76.19	88.89	3	3 1/2	111 to 127	5/16 to 1/2	14.58	9.8
101.59	126.99	4	5	95 to 111	3/8 to 7/16	17.85	12.0	76.19	88.89	3	3 1/2	95 to 111	3/8 to 7/16	12.64	8.5
101.59	76.19	4	3	95 to 111	3/8 to 7/16	13.83	9.3	76.19	63.49	3	2 1/2	95 to 111	3/8 to 7/16	10.71	7.2
101.59	76.19	4	3	111 to 127	5/16 to 1/2	15.17	10.2	76.19	63.49	3	2 1/2	79 to 95	5/16 to 3/8	9.07	6.1
88.89	101.59	3 1/2	4	127 to 142	1/2 to 5/16	19.04	12.8	63.49	76.19	2 1/2	3	95 to 111	3/8 to 7/16	10.71	7.2
88.89	101.59	3 1/2	4	95 to 111	3/8 to 7/16	14.73	9.9	63.49	76.19	2 1/2	3	79 to 95	5/16 to 3/8	9.07	6.1
88.89	76.19	3 1/2	3	127 to 142	1/2 to 5/16	16.22	10.9	63.49	63.49	2 1/2	2 3/4	95 to 111	3/8 to 7/16	9.97	6.7
88.89	76.19	3 1/2	3	95 to 111	3/8 to 7/16	12.64	8.5	63.49	63.49	2 1/2	2 3/4	79 to 95	5/16 to 3/8	8.63	5.8
76.19	101.59	3	4	111 to 127	5/16 to 1/2	15.77	10.6	44.44	31.74	1 3/4	1 3/4	95 to 111	3/8 to 7/16	5.35	3.6
76.19	101.59	3	4	95 to 111	3/8 to 7/16	13.84	9.3	44.44	31.74	1 3/4	1 3/4	47 to 55	3/16 to 3/32	2.88	1.9

Steel bulb Angles, standard sections.



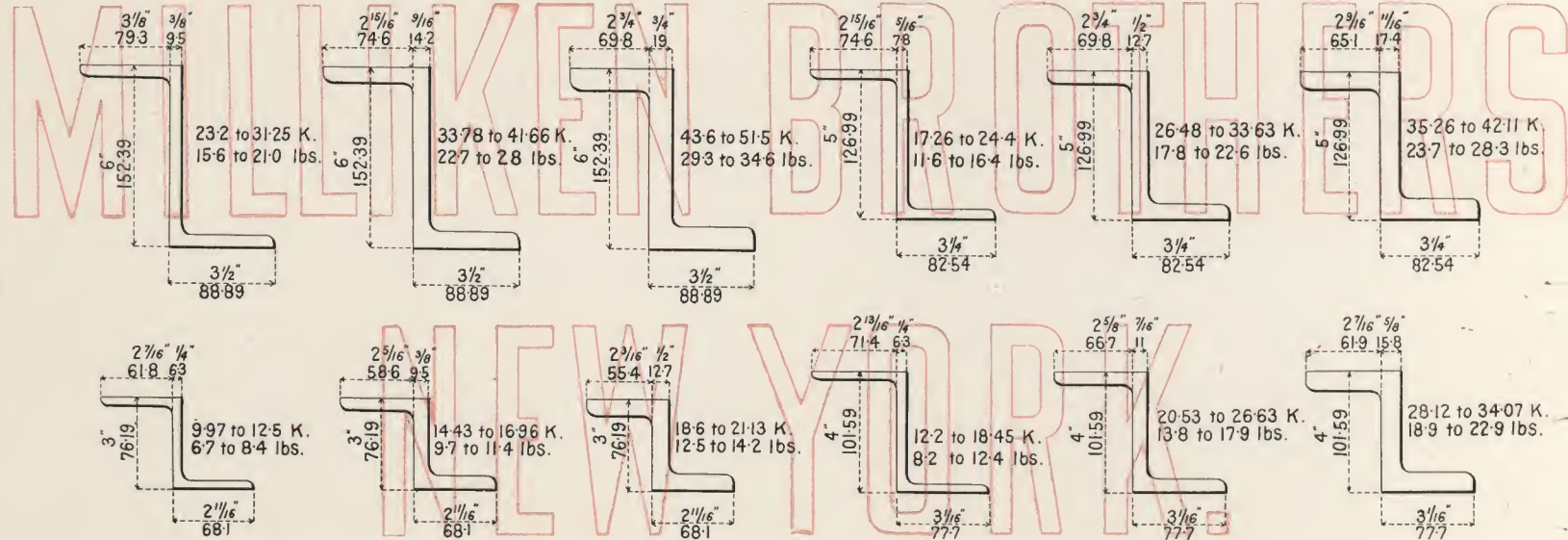
All dimensions are given in millimetres and inches

All weights are given in kilograms per metre and pounds per lineal foot.

*Weights and dimensions of Bulb Angles.
Standard sections.*

<i>Depth of Angle m.m.</i>	<i>Depth of Angle ins.</i>	<i>Weight per M. Kg.</i>	<i>Weight per ft. lbs.</i>	<i>Flange Width m.m.</i>	<i>Flange Width ins.</i>	<i>Web Thickness m.m.</i>	<i>Web Thickness ins.</i>
253.99	10	39.43	26.50	88.89	3½	12.2	0.48
228.59	9	32.44	21.80	88.89	3½	11.1	0.44
203.19	8	28.60	19.23	88.89	3½	10.2	0.41
177.79	7	27.15	18.25	76.19	3	11.1	0.44
152.39	6	25.59	17.20	76.19	3	12.7	0.50
152.39	6	20.45	13.75	76.19	3	9.6	0.38
152.39	6	18.30	12.30	76.19	3	7.9	0.31
126.99	5	14.88	10	63.49	2½	7.9	0.31

Steel Z-Bars, standard sections.



All dimensions are given in millimetres and inches.

All weights are given in kilograms per metre and pounds per lineal foot.

All dimensions given are for minimum weight of each section.

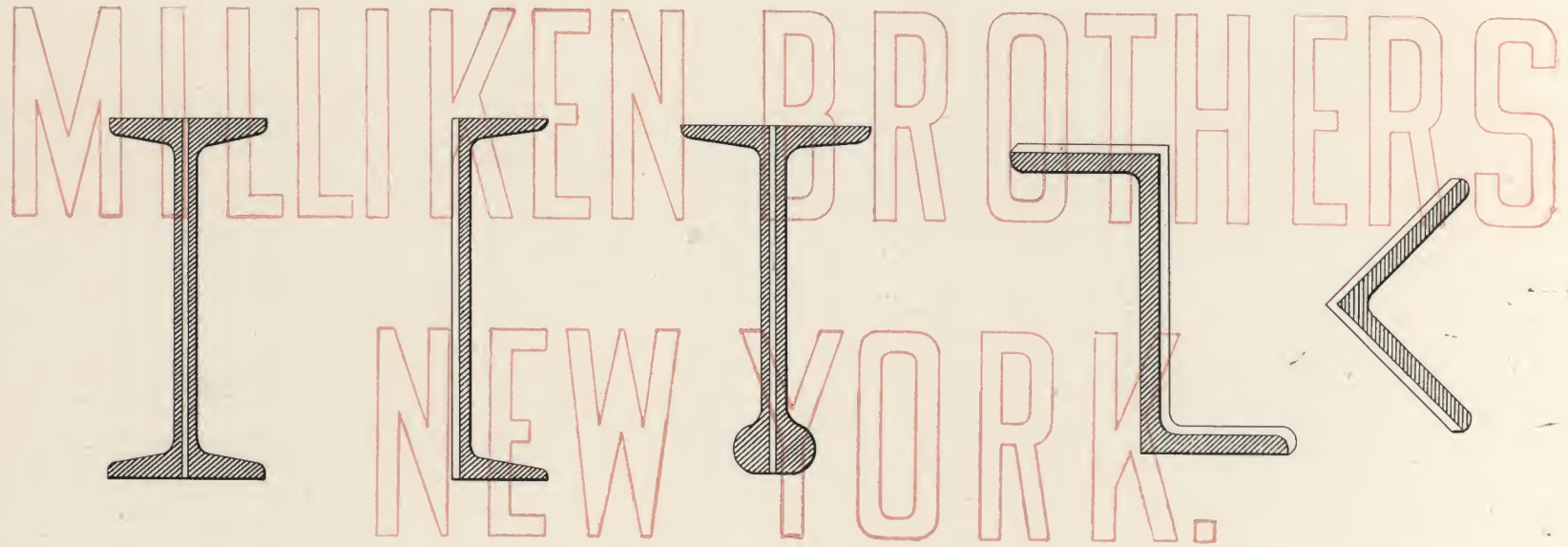
Plate No. 20.

Maximum intermediate and minimum weights and dimensions of steel Z-Bars standard sections.

Thickness m.m.	Thickness ins.	Actual size in m.m.			Actual size in ins.			Weight per M. Kilograms.	Weight per ft. lbs.
		Flange.	Web.	Flange.	Flange.	Web.	Flange.		
634	1/4	6827	7619	6827	2 1/16	3	2 1/16	9.97	6.7
794	5/16	6984	7778	6984	2 3/4	3 1/16	2 3/4	12.50	8.4
950	3/8	6827	7619	6827	2 1/16	3	2 1/16	14.43	9.7
1111	7/16	6984	7778	6984	2 3/4	3 1/16	2 3/4	16.96	11.4
1270	1/2	6827	7619	6827	2 1/16	3	2 1/16	18.60	12.5
1428	9/16	6984	7778	6984	2 3/4	3 1/16	2 3/4	21.13	14.2
634	1/4	7778	10159	7778	3 1/16	4	3 1/16	12.20	8.2
794	5/16	7936	10318	7936	3 1/8	4 1/16	3 1/8	15.32	10.3
950	3/8	8102	10477	8102	3 1/16	4 1/8	3 1/16	18.45	12.4
1111	7/16	7778	10159	7778	3 1/16	4	3 1/16	20.53	13.8
1270	1/2	7936	10318	7936	3 1/8	4 1/16	3 1/8	23.51	15.8
1428	9/16	8102	10477	8102	3 1/16	4 1/8	3 1/16	26.63	17.9
1587	5/8	7778	10159	7778	3 1/16	4	3 1/16	28.12	18.9
1746	11/16	7936	10318	7936	3 1/8	4 1/16	3 1/8	31.10	20.9
1904	3/4	8102	10477	8102	3 1/16	4 1/8	3 1/16	34.07	22.9
794	5/16	8254	12699	8254	3 1/4	5	3 1/4	17.26	11.6
950	3/8	8407	12852	8407	3 1/16	5 1/16	3 5/16	20.68	13.9
1111	7/16	8569	13018	8569	3 3/8	5 1/8	3 3/8	24.40	16.4
1270	1/2	8254	12699	8254	3 1/4	5	3 1/4	26.48	17.8
1428	9/16	8407	12852	8407	3 5/16	5 1/16	3 5/16	30.06	20.2
1587	5/8	8569	13018	8569	3 3/8	5 1/8	3 3/8	33.63	22.6
1746	11/16	8254	12699	8254	3 1/4	5	3 1/4	35.26	23.7
1904	3/4	8407	12852	8407	3 1/16	5 1/16	3 5/16	38.69	26.0
2063	13/16	8569	13018	8569	3 3/8	5 1/8	3 3/8	42.11	28.3
950	3/8	8889	15239	8889	3 1/2	6	3 1/2	23.21	15.6
1111	7/16	9042	15392	9042	3 5/16	6 1/16	3 5/16	27.23	18.3
1270	1/2	9194	15557	9194	3 3/8	6 1/8	3 5/8	31.25	21.0
1428	9/16	8889	15239	8889	3 1/2	6	3 1/2	33.78	22.7
1587	5/8	9042	15392	9042	3 5/16	6 1/16	3 5/16	37.80	25.4
1746	11/16	9194	15557	9194	3 3/8	6 1/8	3 5/8	41.66	28.0
1904	3/4	8889	15239	8889	3 1/2	6	3 1/2	43.60	29.3
2063	13/16	9042	15392	9042	3 5/16	6 1/16	3 5/16	47.62	32.0
2222	7/8	9194	15557	9194	3 3/8	6 1/8	3 5/8	51.50	34.6

Plate No. 21.

Method of increasing sectional areas.



The cross hatched portions represent the minimum sections and the blank portions the added areas.

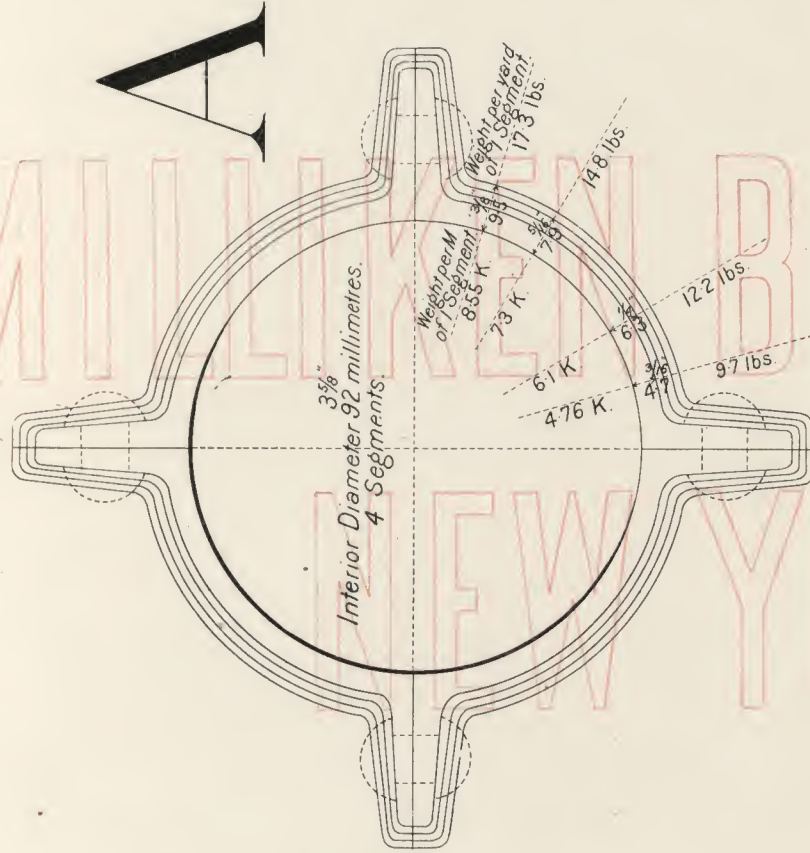


Table of dimensions for Phœnix Columns.—Segments "A."

Thickness	\odot_d		\odot_D		\odot_{D_1}		\odot_{D_2}		\odot_{D_3}		One Column.				Diameter of rivets.	
	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	Area	Weight per sq. ins.	Weight per sq. cm.	Weight per sq. in.	Weight per sq. cm.	Weight per sq. in.
4.76	3/16	92.07	3 5/16	4	153.9	6 1/16	112.6	4 3/16	63.5	2 1/2	245	38	190	129	368	145
6.34	1/4	92.07	3 5/16	4 1/8	157.0	6 3/16	115.2	4 9/16	63.5	2 1/2	309	48	243	163	381	15
7.93	5/16	92.07	3 5/16	4 1/4	160.3	6 5/16	119.0	4 11/16	63.5	2 1/2	374	58	293	197	393	155
9.52	3/8	92.07	3 5/16	4 3/8	163.5	6 7/16	122.0	4 13/16	63.5	2 1/2	438	68	342	231	404	159

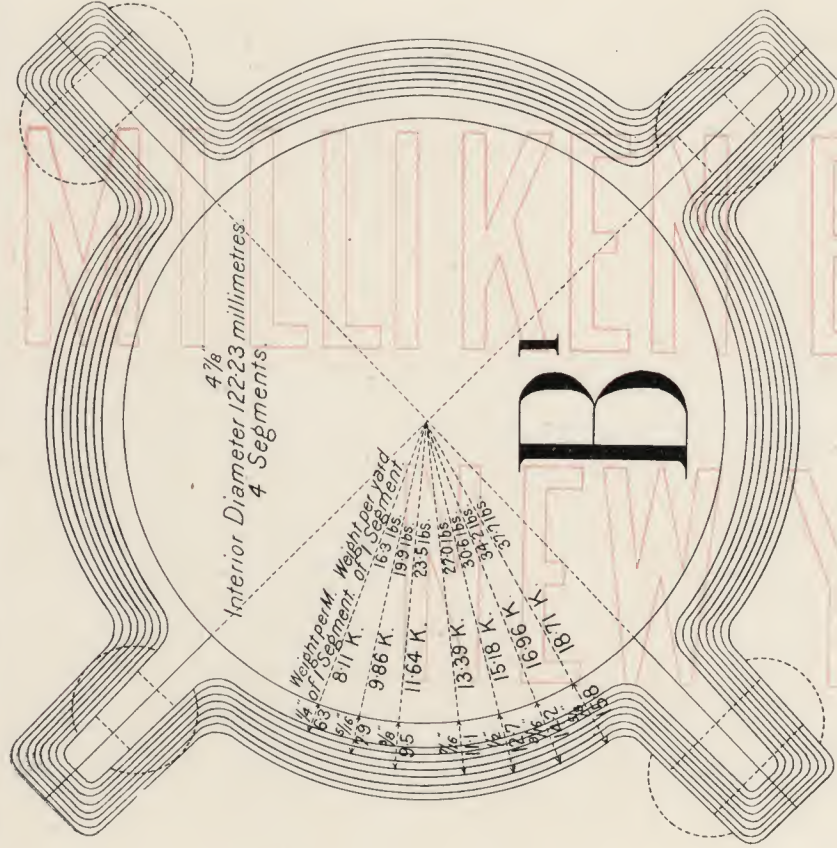


Table of dimensions for Phoenix Columns. Segments "B".

Thickness		One Column.									
		Area		Weight per		Least Radius		Diameter		Diameter	
mm.	ins.	sq. ins.	sq. cm.	M. Kg.	Weight per	mm.	ins.	mm.	ins.	mm.	ins.
63	1/4	123.82	4 7/8	136.52	5 3/8	206.37	8 1/8	152.39	6	86.51	3 3/8
79	5/16	123.82	4 7/8	139.69	5 1/2	207.95	8 3/8	155.57	6 1/8	86.51	3 3/8
95	3/8	123.82	4 7/8	142.87	5 5/8	211.13	8 7/8	158.74	6 3/4	86.51	3 3/8
111	7/16	123.82	4 7/8	146.04	5 3/4	214.30	8 7/8	161.92	6 3/4	86.51	3 3/8
127	1/2	123.82	4 7/8	149.22	5 5/8	215.89	8 7/8	165.09	6 1/2	86.51	3 3/8
142	5/8	123.82	4 7/8	152.39	6	217.48	8 7/8	168.27	6 1/2	86.51	3 3/8
158	3/4	123.82	4 7/8	155.57	6 1/8	220.65	8 7/8	171.44	6 3/4	86.51	3 3/8

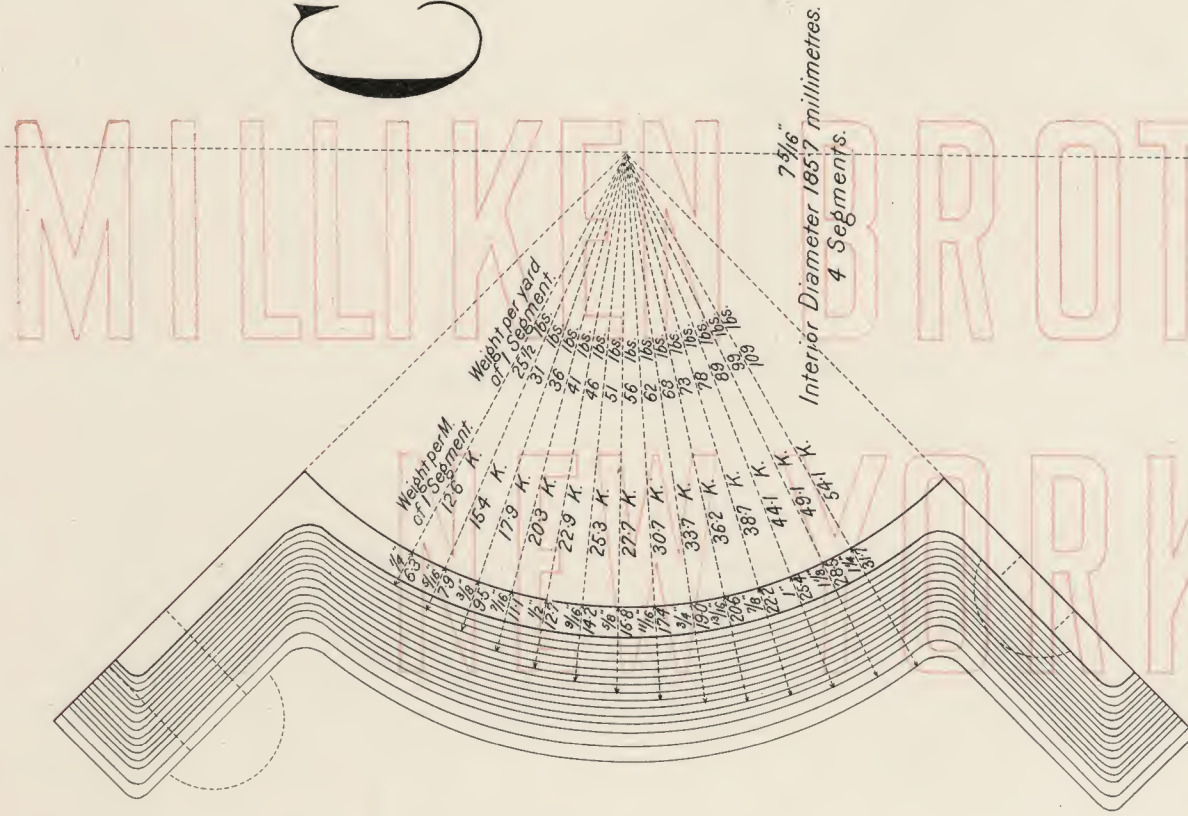


Table of dimensions for Phoenix Columns. Segments "C."

Thickness.	ins. mm.	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	1 7/8"	2"	2 1/8"	2 1/4"	2 3/8"	2 1/2"	2 5/8"	2 3/4"	2 7/8"	3"	3 1/8"	3 1/4"	3 1/2"	3 3/8"	3 1/2"	3 5/8"	3 3/4"	3 7/8"	4"
D	ins. mm.	63	79	95	111	127	142	158	174	190	206	222	238	254	270	286	302	318	334	350	366	382	398	414	430	446	462	478	494	510	526	542	558	574
D1	ins. mm.	108	136	164	192	220	248	276	304	332	360	388	416	444	472	500	528	556	584	612	640	668	696	724	752	780	808	836	864	892	920	948	976	1004
D2	ins. mm.	114	142	170	198	226	254	282	310	338	366	394	422	450	478	506	534	562	590	618	646	674	702	730	758	786	814	842	870	898	926	954	982	1010
Area.	sq. ins. sq. c. m.	10	12.1	14.1	16	18	20.2	23.3	26.6	30.1	33.6	37.1	40.6	44.1	47.6	51.1	54.6	58.1	61.6	65.1	68.6	72.1	75.6	79.1	82.6	86.1	89.6	93.1	96.6	100.1	103.6	107.1	110.6	
Weight.	lbs. per ft. kg. per M.	34	41.3	48	54.6	61.3	68	74.6	82.6	90.6	98.6	106.6	114.6	122.6	130.6	138.6	146.6	154.6	162.6	170.6	178.6	186.6	194.6	202.6	210.6	218.6	226.6	234.6	242.6	250.6	258.6	266.6	274.6	
Least flat polarization	ins. mm.	284	298	312	326	340	354	368	382	396	410	424	438	452	466	480	494	508	522	536	550	564	578	592	606	620	634	648	662	676	690	704	718	
Diameter of rivets.	ins. mm.	5/8"	9/8"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	1 7/8"	2"	2 1/8"	2 1/4"	2 3/8"	2 1/2"	2 5/8"	2 3/4"	2 7/8"	3"	3 1/8"	3 1/4"	3 1/2"	3 3/8"	3 1/2"	3 5/8"	3 3/4"	3 7/8"	4"	4 1/8"	4 1/4"	4 1/2"	4 3/8"	4 1/2"	4 5/8"	4 3/4"	

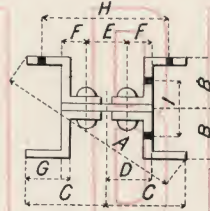
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Table of dimensions for Phoenix Columns-Segments "G."

Thickness.	ins. mm.	3/16	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	1	1 1/8	1 1/4	1 3/8
<i>D</i>	ins. mm.	15 1/4 387 3	15 1/2 390 5	15 3/4 396 8	15 3/4 400 0	15 5/8 403 2	16 406 4	16 1/8 409 5	16 1/4 412 7	16 3/8 415 9	16 1/2 422 2	16 3/4 428 6	17 1/8 434 9	17 3/8 441 3
<i>DI</i>	ins. mm.	19 3/8 492 1	19 1/2 495 2	19 3/4 498 4	19 3/4 500 0	19 1/2 501 6	19 1/4 507 9	19 1/4 511 1	19 1/2 514 3	19 3/4 517 5	20 523 8	20 1/8 530 2	20 1/4 533 4	21 1/4 539 7
<i>D2</i>	ins. mm.	18 1/8 460 3	18 1/4 463 5	18 1/2 466 7	18 3/4 469 9	18 3/4 473 0	18 7/8 479 4	18 7/8 482 5	19 485 7	19 1/4 488 9	19 1/2 495 3	19 3/4 501 6	20 507 9	20 1/4 514 3
<i>One Column</i>	Area sq. ins. sq. cm.	242 156 1	281 181 2	32 206 4	36 232 2	39 3/8 257 4	43 7/8 307 7	47 7/8 333 5	51 7/8 358 7	55 5/8 384 5	59 6 434 8	63 1 468 7	67 1/8 536 4	70 9 566 4
	Weight lbs. per ft. kg. per m.	82 6 123 2	96 142 4	109 3 162 6	122 6 182 4	136 202 3	149 3 222 1	162 6 241 9	176 281 7	189 3 301 5	202 6 341 2	216 360 9	226 5 420 1	239 3 460 2
	Least Rad. ins. mm.	5 54 140 7	5 59 141 9	5 64 143 2	5 68 145 5	5 73 145 5	5 82 147 8	5 88 149 3	5 91 150 1	5 95 151 1	6 04 153 4	6 07 155 6	6 12 159 2	6 27 160 5
	Diameter of rivets mm	5 1/8 158	5 1/8 158	5 1/8 158	5 1/8 158	5 1/8 158	5 3/4 147 8	5 3/4 149 3	5 3/4 150 1	5 3/4 151 1	5 3/4 153 4	5 3/4 155 6	5 3/4 159 2	5 3/4 160 5

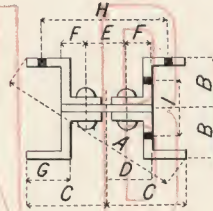
Table of dimensions for 12" (304.8 m.m.) Z-Bar Columns.



Thickness of metal.		A		B		C		D		E		F		G		H		I	
m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.
95	3/8	479.4	18 7/8	157.1	6 3/16	180.9	7 1/8	101.6	4	101.6	4	50.8	2	88.9	3 1/2	285.7	11 1/4	161.9	6 3/8
127	1/2	482.6	19	161.9	6 3/8	180.9	7 1/8	101.6	4	101.6	4	50.8	2	92.0	3 5/8	279.4	11	171.4	6 3/4
158	5/8	476.2	18 3/4	161.9	6 3/8	176.2	6 15/16	101.6	4	101.6	4	50.8	2	90.4	3 9/16	273.0	10 3/4	169.8	6 1/2
190	3/4	471.4	18 5/8	161.9	6 3/8	171.4	6 3/4	101.6	4	101.6	4	50.8	2	88.9	3 1/2	266.7	10 1/2	171.4	6 3/4
222	7/8	474.6	18 11/16	166.6	6 3/8	171.4	6 3/4	101.6	4	101.6	4	50.8	2	92.0	3 5/8	260.3	10 1/4	177.8	7

Section: 4 Z-Bars 152.4-155.5 m.m. deep.
 6" 6 1/8"
 8"
 1 Web Plate 203.2 m.m. x thickness of Z-Bars.

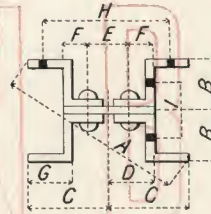
Table of dimensions for 10" (254 m.m.) Z-Bar Columns.



Thickness of metal.		A		B		C		D		E		F		G		H		I	
m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.
79	5/16	419.1	16 1/2	130.9	5 1/32	163.5	6 7/16	88.9	3 1/2	82.4	3 1/4	47.6	1 7/8	82.5	3 1/4	257.1	10 1/8	134.9	5 5/16
11.1	7/16	422.2	16 5/8	135.7	5 1/32	163.5	6 7/16	88.9	3 1/2	82.4	3 1/4	47.6	1 7/8	85.7	3 3/8	250.8	9 7/8	141.2	5 5/16
14.2	9/16	417.5	16 1/16	135.7	5 1/32	158.7	6 1/4	88.9	3 1/2	82.4	3 1/4	47.6	1 7/8	84.1	3 3/16	244.4	9 5/8	142.8	5 5/8
17.4	11/16	411.1	16 3/16	135.7	5 1/32	153.9	6 1/8	88.9	3 1/2	82.4	3 1/4	47.6	1 7/8	82.5	3 1/4	238.1	9 3/8	144.4	5 11/16
20.6	13/16	414.3	16 3/8	140.5	5 1/32	153.9	6 1/8	88.9	3 1/2	82.4	3 1/4	47.6	1 7/8	85.7	3 3/8	231.7	9 1/8	150.8	5 15/16

Section: 4 Z-Bars 5" 5/8" 126.99-130.17 m.m. deep.
 7" Web Plate 177.79 m.m. x thickness of Z-Bars.

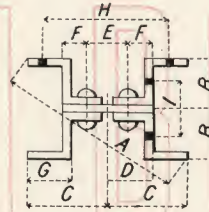
Table of dimensions for 8" (203.2 m.m) Z-Bar Columns.



Thickness of metal		A		B		C		D		E		F		G		H		I	
m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.
63	1/4	373.0	14 11/16	104.7	4 1/8	153.8	6 1/16	82.5	3 1/4	76.2	3	44.4	1 3/4	77.7	3 1/16	241.3	9 1/2	107.9	4 1/4
9.5	3/8	376.2	14 13/16	109.5	4 3/16	153.8	6 1/16	82.5	3 1/4	76.2	3	44.4	1 3/4	80.9	3 3/16	234.9	9 1/4	114.3	4 1/2
12.7	1/2	369.8	14 5/16	109.5	4 5/16	149.2	5 7/8	82.5	3 1/4	76.2	3	44.4	1 3/4	79.3	3 1/8	228.6	9	115.8	4 5/16
15.8	5/8	361.9	14 1/4	109.5	4 3/16	144.4	5 11/16	82.5	3 1/4	76.2	3	44.4	1 3/4	77.7	3 1/8	222.2	8 3/4	117.4	4 3/8
19.0	3/4	365.1	14 3/8	114.3	4 1/2	144.4	5 11/16	82.5	3 1/4	76.2	3	44.4	1 3/4	80.9	3 3/8	215.9	8 1/2	123.8	4 7/8

Section: 4 Z-Bars 101.59-104.77 m.m. deep.
 4" 4 1/8"
 6 1/2"
 1 Web Plate 165 m.m. x thickness of Z-Bars.

Table of dimensions for 6" (152.39 m.m.) Z-Bar Columns.



Thickness of metal.		A		B		C		D		E		F		G		H		I	
m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.	m.m.	ins.
6.3	1/4	312.7	12 5/16	79.3	3 1/8	134.9	5 5/16	73	2 7/8	63.5	2 1/2	41.2	1 5/8	68.2	2 11/16	215.9	8 1/2	82.5	3 1/4
7.9	5/16	314.3	12 3/8	81.7	3 3/32	134.9	5 5/16	73	2 7/8	63.5	2 1/2	41.2	1 5/8	69.8	2 3/4	212.7	8 3/8	85.7	3 3/8
9.5	3/8	309.5	12 1/8	80.9	3 1/16	131.7	5 1/8	73	2 7/8	63.5	2 1/2	41.2	1 5/8	68.2	2 11/16	209.5	8 1/4	85.7	3 3/8
11.1	7/16	311.1	12 1/4	83.3	3 9/32	131.7	5 1/8	73	2 7/8	63.5	2 1/2	41.2	1 5/8	69.8	2 3/4	206.3	8 1/8	88.9	3 1/2
12.7	1/2	304.7	12	82.5	3 1/4	128.5	5 1/8	73	2 7/8	63.5	2 1/2	41.2	1 5/8	68.2	2 11/16	203.2	8	88.9	3 1/2
14.2	9/16	306.3	12 1/16	84.9	3 1/32	128.5	5 1/8	73	2 7/8	63.5	2 1/2	41.2	1 5/8	69.8	2 3/4	200.0	7 7/8	92.0	3 5/8

Section: 4 Z-Bars $3'' \frac{3}{16}''$ 762-777 m.m. deep.
 5 3/4
 1 Web Plate 146 m.m. x thickness of Z-Bars.

EXPLANATION OF PLATES OF ROLLED SECTIONS.

It will be noticed that on all of these plates the dimensions are given both in inches and in millimetres, and the weights are given in pounds per lineal foot and in kilograms per metre.

Plate No 1 and Plate No. 2 give the dimensions of the various bars and plates that we are able to furnish; that is rounds, squares, half rounds and rectangular plates.

The following plates, commencing with Plate No. 3 and extending to Plate No. 31, give the dimensions of the various classes of structural material. The sections as shown on these plates have been calculated for the lightest weights to which each shape or pattern can be rolled. It is possible to roll heavier sections as shown on Plates Nos. 6, 9, 11, 13, 16, 18, 20, 22, 23, 24, 25, 26 and 27. This is accomplished by means of separating or spreading the rolls, the method being clearly illustrated on Plate No 21.

It is well to note that the extra heavy sections are not always kept in stock and are therefore obtained only by special rolling which requires an order of a sufficient weight to warrant the changing of the rolls. It is therefore advantageous for parties ordering to confine themselves as far as possible to the minimum weights, if quick delivery is required.

In ordering rolled sections, it is necessary that the order be clearly written out to avoid any misunderstanding. The usual practice, as adopted in this country, and which we would like our customers to be

careful to follow to avoid any mistakes is to specify, first, the number of pieces wanted; then the name of the piece required, and following this the dimension and the weight, and lastly the length of each bar.

In describing rounds, the diameter is given.

In describing squares, one side of the square is given.

In describing half rounds, the diameter is given.

In describing plates, the width and thickness are given.

In describing beams, deck beams and channels, the depth is given.

In describing angles, the length of each leg is given.

In describing Tees, the depth of stem and the width of the flange are given.




It is very important in describing Tees with unequal legs to introduce a sketch on the order, to give the dimension of the vertical leg and of the horizontal flange so no mistake can be made.

In describing Bulb angles, the depth is given.

In describing Zee bars, the depth is given and the length of each horizontal flange.

Phoenix and Zee bar columns are always ordered by drawings; it being impossible to order them by any general description on account of the riveted connections, that is the cap and base plates. These with any intermediate connections should be shown on drawings to avoid misunderstanding.

To clearly illustrate what we have mentioned above relative to ordering raw material, we give the following illustration of how an order should read, specifying the different classes of material, as ordered in feet, inches and pounds.

NUMBER OF PIECES.	DESCRIPTION.	DIMENSIONS AND WEIGHT.	LENGTH.	
6	Bars, round	1 1/2 in. diameter	10 ft.	6 in.
5	Bars, square	2 " square	8 "	6 "
3	Bars, half round	1 3/8 " diameter	15 "	0 "
10	Plates	25 " x 3/8 in.	20 "	10 "
4	Beams	15 " 80 lbs.	26 "	8 "
8	Deck Beams	10 " 35 lbs.	14 "	10 "
5	Channels	9 " 25 lbs.	21 "	0 "
12	Angles	6 " x 6 in., 33.1 lbs.	27 "	8 "
12	Angles	5 " x 3 " 8.2 "	16 "	4 "
4	Tees 	4 " x 4 " 13.7 "	8 "	1 "
4	Tees 	4 " x 3 " 10.2 "	15 "	2 "
4	Tees 	3 " x 4 " 10.6 "	10 "	1 "
6	Bulb Angles	8 " 19.23 lbs.	17 "	8 "
4	Zee Bars	5 " x 3 1/4 in. x 3 1/4 in., 11.6 lbs.	13 "	2 "

All weights are given in pounds per foot.

TABLES
GIVING STRENGTH OF STEEL AND IRON WORK

MANUFACTURED BY

MILLIKEN BROTHERS,

11 BROADWAY,
NEW YORK CITY, U. S. A.

Table No. 1.

*Safe Loads in Kilograms and Pounds uniformly distributed
for steel I-Beams standard sections.*

Length of Span in M.	Length of Span in ft.	Depth of Beam 24" 609.58 m.m.												Depth of Beam 20" 507.99 m.m.													
		Weight per ft. 100 lbs.	Weight per M. 148.82 Kgs.	Weight per ft. 95 lbs.	Weight per M. 141.38 Kgs.	Weight per ft. 90 lbs.	Weight per M. 133.93 Kgs.	Weight per ft. 85 lbs.	Weight per M. 126.49 Kgs.	Weight per ft. 80 lbs.	Weight per M. 119.05 Kgs.	Weight per ft. 100 lbs.	Weight per M. 148.82 Kgs.	Weight per ft. 95 lbs.	Weight per M. 141.38 Kgs.	Weight per ft. 90 lbs.	Weight per M. 133.93 Kgs.	Weight per ft. 85 lbs.	Weight per M. 126.49 Kgs.	Weight per ft. 80 lbs.	Weight per M. 119.05 Kgs.	Weight per ft. 75 lbs.	Weight per M. 111.61 Kgs.	Weight per ft. 70 lbs.	Weight per M. 104.17 Kgs.	Weight per ft. 65 lbs.	Weight per M. 96.73 Kgs.
4	13.123	161226	73131	156432	70957	151662	68793	146885	66626	141422	64148	134579	61044	130600	59239	126615	57432	122629	55624	119202	54069	103137	46782	99152	44975	95068	43122
4.5	14.764	143313	65006	139050	63072	134812	61150	130566	59224	125707	57020	119625	54261	116086	52656	112546	51050	109004	49444	105974	48060	91676	41584	88132	39976	84503	38330
5	16.404	128981	58505	125145	56765	121331	55035	117508	53301	113137	51318	107662	48835	104479	47391	101291	45945	98103	44499	95361	43255	82510	37426	79322	35980	76054	34498
5.5	18.044	117255	53186	113767	51604	110299	50031	106825	48455	102852	46653	97873	44395	94982	43083	92082	41768	89185	40454	86630	39322	75007	34023	72111	32709	69141	31362
6	19.685	107484	48754	104287	47304	101108	45862	97922	44417	94280	42765	89719	40696	87067	39493	84410	38288	81754	37083	79467	36046	68757	31188	66101	29983	63378	28746
6.5	21.325	99214	45003	96265	43665	93330	42334	90389	41000	87027	39475	82816	37565	80369	36455	77916	35342	75464	34230	73354	33273	63468	28789	61017	27677	58501	26536
7	22.966	92128	41789	89390	40547	86663	39310	83934	38072	80812	36656	76901	34882	74629	33851	72351	32818	70073	31785	68114	30896	58936	26733	56659	25700	54324	24641
7.5	24.606	85986	39003	83429	37843	80885	36689	78337	35533	75424	34212	71773	32556	69652	31594	67527	30630	65402	29666	63572	28836	55005	24950	52980	23986	50702	22998
8	26.247	80613	36565	78216	35478	75832	34396	73442	33313	70711	32074	67289	30522	65300	29619	63307	28716	61314	27812	59601	27034	51568	23391	49576	22487	47534	21561
8.5	27.887	75869	34414	73615	33391	71370	32373	69121	31353	66550	30187	63329	28726	61458	27877	59582	27026	57708	26176	56094	25444	48535	22015	46658	21164	44735	20292
9	29.528	71656	32503	69525	31536	67406	30575	65283	29612	62853	28510	59812	27130	58043	26328	56273	25525	54502	24722	52987	24030	45838	20792	44066	19988	42251	19165
9.5	31.168	67884	30792	65867	29877	63856	28965	61843	28052	59544	27009	56663	25702	54990	24943	53312	24182	51632	23420	50188	22765	43424	19697	41746	18936	40027	18156
10	32.808	64490	29252	62572	28382	60665	27517	58754	26650	56668	26659	53831	24417	52239	23695	50645	22972	49051	22249	47681	21627	41255	18713	39661	17990	38027	17248
		C1-2115800	C 292524	C1-2052900	C 283827	C1-1990300	C 275173	C1-1927600	C 266604	C1-1855900	C 256691	C1-1766100	C 244175	C1-1713900	C 236958	C1-1661600	C 229728	C1-1609300	C 222497	C1-1564300	C 216275	C1-1353500	C 187130	C1-1301200	C 179900	C1-1247600	C 172489

C1 = Coefficient of strength for maximum fiber stress of 16000 lbs. per sq. in.

C = Coefficient of strength for maximum fiber stress of 1125 kgs. per sq. cm.

For a single load concentrated at the centre of the beam take one half ($\frac{1}{2}$) the load given in the table.

Table No. 2.

*Safe Loads in Kilograms and Pounds uniformly distributed
for steel I-Beams standard sections.*

Length of Span in M. Length of Span in ft.	Depth of Beam 15" 380.94 m. m.																																																			
	Weight per ft. 100 lbs.	Weight per M. 148.82 kgs.	Weight per ft. 95 lbs.	Weight per M. 141.38 kgs.	Weight per ft. 90 lbs.	Weight per M. 133.93 kgs.	Weight per ft. 85 lbs.	Weight per M. 126.49 kgs.	Weight per ft. 80 lbs.	Weight per M. 119.05 kgs.	Weight per ft. 75 lbs.	Weight per M. 111.61 kgs.	Weight per ft. 70 lbs.	Weight per M. 104.17 kgs.	Weight per ft. 65 lbs.	Weight per M. 96.73 kgs.	Weight per ft. 60 lbs.	Weight per M. 89.29 kgs.	Weight per ft. 55 lbs.	Weight per M. 81.85 kgs.	Weight per ft. 50 lbs.	Weight per M. 74.41 kgs.	Weight per ft. 45 lbs.	Weight per M. 66.96 kgs.	Weight per ft. 40 lbs.	Weight per M. 62.50 kgs.																										
4	13123	97589	44266	94602	42911	91614	41556	88621	40198	86205	39102	74904	33976	71919	32622	68930	31267	65997	29936	55382	26721	52388	23763	49392	22404	47877	21717																									
4.5	14764	86747	39348	84093	38144	81434	36938	78776	35732	76628	34758	66584	30202	63924	28996	61271	27792	58662	26609	49230	22330	46566	21122	43902	19914	42555	19303																									
5	16404	78022	35413	75682	34329	73293	33245	70896	32158	68964	31282	59924	27181	57533	26097	55144	25013	52798	23949	44306	20097	41910	19010	39513	17923	38300	17373																									
5.5	18044	70973	32193	68801	31208	66628	30222	64450	29234	62694	28438	54476	24710	52302	23724	50131	22739	47996	21771	40278	18270	38098	17281	35920	16293	34817	15793																									
6	19685	65060	29511	63069	28608	61077	27704	59081	26799	57470	26068	49937	22651	47946	21748	45952	20844	43997	19957	36920	16747	34925	15842	32928	14936	31916	14477																									
6.5	21325	60054	27240	58217	26407	56379	25573	54536	24737	53050	24063	46094	20908	44257	20075	42419	19241	40613	18422	34081	15459	32238	14623	30395	13787	29462	13364																									
7	22966	55766	25295	54061	24521	52350	23746	50640	22970	49260	22344	42802	19415	41095	18641	39389	17867	37712	17106	31647	14355	29936	13579	28223	12802	27357	12409																									
7.5	24606	52046	23608	50455	22886	48861	22163	47265	21439	45974	20854	38947	18120	38356	17398	36762	16675	34196	15965	29537	13398	27939	12673	26343	11949	25534	11582																									
8	26247	48795	22133	47302	21456	45807	20778	44310	20099	43102	19551	37452	16988	35959	16311	34464	15633	32998	14968	27690	12560	26194	11881	24696	11202	23938	10858																									
8.5	27887	45924	20831	44517	20193	43113	19556	41702	18916	40567	18401	35249	15989	33843	15351	32336	14713	31056	14087	26060	11821	24652	11182	23283	10543	22529	10219																									
9	29528	43373	19674	42046	19072	40717	18469	39387	17866	38314	17379	33294	15101	31362	14498	30635	13896	29331	13305	24615	11165	23283	10561	21951	9957	21277	9652																									
9.5	31168	41089	18638	39822	18068	38574	17497	37313	16925	36296	16464	31526	14305	30280	13735	29024	13165	27787	12604	23318	10577	22057	10005	20796	9433	20156	9143																									
10	32808	39035	17706	37840	17164	36545	16622	35448	16079	34482	15641	29962	13590	28766	13048	27571	12506	26399	11974	22152	10048	20955	9505	19754	8961	19150	8686																									
	C1-1280700		C 177064		C1-1241500		C 171646		C1-1202300		C 166226		C1-1163000		C 160793		C1-1131300		C 156410		C1-983000		C 135906		C1-943800		C 130487		C1-904600		C 125067		C1-866100		C 119744		C1-726800		C 100485		C1-687500		C 95052		C1-648200		C 89618		C1-628300		C 86867	

C1 = Coefficient of strength for maximum fiber stress of 16000 lbs. per sq. in.

C = Coefficient of strength for maximum fiber stress of 1125 kgs. per sq. cm

For a single load concentrated at the centre of the beam take one half ($\frac{1}{2}$) the load given in the table.

Table No. 3.

*Safe Loads in Kilograms and Pounds uniformly distributed
for steel I-Beams standard sections.*

Length of Span in M. Length of Span in ft.	18" Depth of Beam 457.19 m.m.										12" Depth of Beam 304.79 m.m.										10" Depth of Beam 253.99 m.m.									
	Weight per ft. 70 lbs.	Weight per M. 104.17 kgs.	Weight per ft. 65 lbs.	Weight per M. 96.73 kgs.	Weight per ft. 60 lbs.	Weight per M. 89.29 kgs.	Weight per ft. 55 lbs.	Weight per M. 81.85 kgs.	Weight per ft. 55 lbs.	Weight per M. 81.85 kgs.	Weight per ft. 50 lbs.	Weight per M. 74.4 kgs.	Weight per ft. 45 lbs.	Weight per M. 66.96 kgs.	Weight per ft. 40 lbs.	Weight per M. 59.52 kgs.	Weight per ft. 35 lbs.	Weight per M. 52.08 kgs.	Weight per ft. 31.5 lbs.	Weight per M. 46.87 kgs.	Weight per ft. 40 lbs.	Weight per M. 59.52 kgs.	Weight per ft. 35 lbs.	Weight per M. 52.08 kgs.	Weight per ft. 30 lbs.	Weight per M. 44.64 kgs.	Weight per ft. 25 lbs.	Weight per M. 37.20 kgs.		
4	13123	83422	37740	79615	36713	76026	34485	71856	32594	43479	19722	41087	18637	38702	17555	36431	16525	30922	14026	29237	13262	25794	11700	23803	10798	21816	9896	19850	9004	
4.5	14764	73956	33546	70768	32100	67575	30652	63872	28972	38646	17530	36521	16566	34400	15604	32384	14689	27487	12468	25988	11788	22928	10400	21160	9598	19392	8796	17643	8003	
5	16404	66560	30192	63691	28890	60810	27583	57485	26075	34784	15778	32868	14909	30961	14044	29145	13220	24738	11221	23387	10609	20635	9360	19043	8638	17451	7916	15880	7203	
5.5	18044	60505	27447	57900	26263	55292	25080	52258	23704	31620	14343	29879	13553	28146	12767	26495	12018	22488	10201	21263	9645	18759	8509	17310	7852	15864	7196	14436	6548	
6	19685	55468	25160	53076	24075	50681	22989	47904	21729	28986	13148	27390	12424	25800	11703	24286	11016	20615	9351	19491	8841	17196	7800	15869	7198	14543	6596	13232	6002	
6.5	21325	51202	23225	48994	22223	46784	21221	44218	20057	26754	12136	25282	11468	23816	10803	22418	10169	19028	8631	17992	8161	15873	7200	14644	6643	13424	6089	12213	5540	
7	22966	47544	21566	45493	20636	43441	19705	41061	18625	24844	11269	23477	10649	22114	10031	20818	9443	17670	8015	16706	7578	14739	6686	13602	6170	12467	5655	11342	5145	
7.5	24606	44373	20128	42460	19260	40545	18391	38373	17383	23188	10518	21911	9939	20639	9362	19429	8813	16490	7480	15593	7073	13756	6240	12694	5758	11636	5278	10587	4802	
8	26247	41601	18870	39806	18056	38011	17242	35928	16297	21739	9861	20542	9318	19350	8777	18214	8262	15461	7013	14618	6631	12897	5850	11903	5399	10908	4948	9925	4502	
8.5	27887	39153	17760	37462	16993	35776	16228	33814	15338	20461	9281	19334	8770	18212	8261	17143	7776	14550	6600	13759	6241	12138	5506	11201	5081	10267	4657	9341	4237	
9	29528	36977	16773	35384	16050	33787	15326	31936	14486	19323	8765	18260	8283	17200	7802	16190	7344	13744	6234	12994	5894	11464	5200	10580	4799	9696	4398	8823	4002	
9.5	31168	35031	15890	33521	15205	32008	14519	30254	13723	18307	8304	17300	7847	16294	7391	15337	6957	13018	5905	12310	5584	10860	4926	10022	4546	9184	4166	8357	3791	
10	32808	33280	15096	31845	14445	30408	13793	28741	13037	17390	7888	16433	7454	15481	7022	14572	6610	12368	5610	11693	5304	10317	4680	9521	4319	8726	3958	7941	3601	
	CI-1091900	C 150962	CI-1044800	C 144451	CI-997700	C 137939	CI-943000	C 130376	CI-570600	C 78889	CI-539200	C 74548	CI-507900	C 70220	CI-478100	C 66100	CI-405800	C 56104	CI-383700	C 53049	CI-338500	C 46800	CI-312400	C 43191	CI-286300	C 39583	CI-260500	C 36016		

CI= Coefficient of strength for maximum fiber stress of 16000 lbs. per sq.in.

C= Coefficient of strength for maximum fiber stress of 1125 kgs. per sq.c.m.

For a single load concentrated at the centre of the beam take one half ($\frac{1}{2}$) the load given in the table.

Table No. 4.

*Safe Loads in Kilograms and Pounds uniformly distributed
for steel I-Beams standard sections.*

Length of Span in M.		Depth of Beam 228.59 mm. 9"															
Length of Span in ft.		Weight per ft. 35 lbs.		Weight per M 52.08 Kgs.		Weight per ft. 30 lbs.		Weight per M 44.64 Kgs.		Weight per ft. 25 lbs.		Weight per M 37.20 Kgs.		Weight per ft. 21 lbs.		Weight per M 31.25 Kgs.	
		lbs	Kgs	lbs	Kgs	lbs	Kgs	lbs	Kgs	lbs	Kgs	lbs	Kgs	lbs	Kgs		
4	13/23	20192	9159	18400	8347	6600	7531	15338	6958								
4.5	14/26	17950	8142	61354	7418	14758	6694	13633	6184								
5	16/40	16153	7327	14722	6678	13282	6025	12250	5566								
5.5	18/44	14685	6661	13384	6071	12074	5477	11155	5060								
6	19/685	13461	6106	12268	5565	11069	5021	10224	4638								
6.5	21/325	12425	5636	11322	5136	10216	4634	9437	4281								
7	22/366	11539	5234	10513	4769	9486	4303	8765	3976								
7.5	24/606	10769	4885	9872	4451	8853	4016	8179	3710								
8	26/247	10096	4579	9200	4173	8300	3766	7669	3479								
8.5	27/887	9502	4310	8660	3928	7813	3644	7217	3274								
9	29/528	8975	4071	8177	3709	7379	3347	6815	3092								
		C1-265000	C 36638	C1-241500	C 33389	C1-217900	C 30126	C1-201300	C 27831								

[illegible]

$C1$ = Coefficient of strength for maximum fiber stress of 16000 lbs. per sq. in.

C = Coefficient of strength for maximum fiber stress of 1125 kps. per sq.c.m.

For a single load concentrated at the centre of the beam take one half ($\frac{1}{2}$) the load given in the table.

Table No. 5.

*Safe Loads in Kilograms and Pounds uniformly distributed
for steel I-Beams standard sections.*

Length of Span in M.	Length of Span in ft.	Depth of Beam 152.39 m.m.						Depth of Beam 126.99 m.m.						Depth of Beam 101.59 m.m.						Depth of Beam 76.19 m.m.							
		Weight per ft. 17.25 lbs.	Weight per M. 23.67 Kgs.	Weight per ft. 14.75 lbs.	Weight per M. 21.95 Kgs.	Weight per ft. 12.25 lbs.	Weight per M. 18.23 Kgs.	Weight per ft. 14.75 lbs.	Weight per M. 21.95 Kgs.	Weight per ft. 12.25 lbs.	Weight per M. 18.23 Kgs.	Weight per ft. 9.75 lbs.	Weight per M. 14.51 Kgs.	Weight per ft. 10.5 lbs.	Weight per M. 15.62 Kgs.	Weight per ft. 9.5 lbs.	Weight per M. 14.13 Kgs.	Weight per ft. 8.5 lbs.	Weight per M. 12.64 Kgs.	Weight per ft. 7.5 lbs.	Weight per M. 11.16 Kgs.	Weight per ft. 7.5 lbs.	Weight per M. 11.16 Kgs.	Weight per ft. 6.5 lbs.	Weight per M. 9.67 Kgs.	Weight per ft. 5.5 lbs.	Weight per M. 8.18 Kgs.
1.5	4.921	18920	8582	7332	7862	15747	7143	13126	5954	11808	5356	10485	4756	7742	3512	7315	3318	6887	3124	6459	2930	4206	1908	3880	1760	3576	1622
2	6.561	14189	6436	12998	5896	11810	5357	9843	4465	8854	4016	7864	3567	5805	2633	5485	2488	5167	2344	4845	2198	3155	1431	2910	1320	2680	1216
2.5	8.202	11349	5148	10401	4718	9449	4286	7875	3572	7081	3212	6296	2856	4643	2106	4387	1990	4131	1874	3875	1758	2522	1144	2328	1056	2165	972
3	9.842	9460	4291	8666	3931	7873	3572	6563	2977	5904	2678	5242	2378	3871	1756	3657	1659	3443	1562	3229	1465	2103	954	1940	880	1788	811
3.5	11.483	8008	3678	7429	3370	6757	3065	5626	2552	5057	2294	4493	2038	3315	1504	3135	1422	2949	1338	2769	1256	1803	818	1662	754	1508	694
4	13.123	7094	3218	6499	2948	5905	2679	4921	2233	4427	2008	3932	1783	2902	1317	2747	1244	2583	1172	2422	1099	1577	715	1455	660	1340	608
4.5	14.764	6307	2861	5777	2621	5249	2381	4375	1985	3936	1785	3495	1585	2580	1171	2438	1106	2295	1041	2153	977	1402	636	1294	587	1190	540
5	16.404	5674	2574	5200	2359	4724	2143	3937	1786	3540	1606	3148	1427	2321	1053	2193	995	2065	937	1937	879	1261	572	1164	528	1082	486
5.5	18.044	5158	2340	4726	2144	4594	1948	3580	1624	3218	1460	2861	1298	2109	957	1995	905	1876	851	1761	799	1146	520	1058	480	974	442
6	19.685	4730	2145	4333	1965	3937	1786	3281	1488	2952	1339	2621	1189	1935	878	1828	829	1721	781	1614	732	1051	477	970	440	894	405
6.5	21.325	4365	1980	3999	1814	3633	1648	2994	1358	2722	1235	2418	1097	1785	810	1686	765	1589	721	1490	676	970	440	895	406	824	374
		C 1-93100	C 12872	C 1-85300	C 11793	C 1-77500	C 10715	C 1-64600	C 8931	C 1-58100	C 8033	C 1-51600	C 7134	C 1-38100	C 5267	C 1-36000	C 4977	C 1-33900	C 4687	C 1-31800	C 4396	C 1-20700	C 2862	C 1-19100	C 2640	C 1-17600	C 2433

C1 = Coefficient of strength for maximum fiber stress of 16000 lbs. per sq. in.

C = Coefficient of strength for maximum fiber stress of 1125 kgs. per sq. cm.

For a single load concentrated at the centre of the beam take one half ($\frac{1}{2}$) the load given in the table.

Table No. 6.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.— Segments "A."*

Thickness.	ins. m.m.	3/16	4.7	1/4	6.3	5/16	7.9	3/8	9.5
Area.	sq ins. sq.c.m.	3.8	24.5	4.8	30.9	5.8	37.4	6.8	43.8
Least Radius of Gyration.	ins. m.m.	1.45	36.8	1.5	38.1	1.55	39.3	1.59	40.4
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	46974	21307	59623	27045	72326	32807	84960	38538
3.5	11.483	45943	20840	58366	26475	70855	32140	83278	37775
4	13.123	44912	20372	57109	25905	69384	31473	81596	37012
4.5	14.764	43881	19904	55852	25335	67913	30806	79914	36249
5	16.404	42850	19436	54595	24765	66442	30139	78232	35486

Segments "B1."

Thickness.	ins. m.m.	1/4	6.3	5/16	7.9	3/8	9.5	7/16	11.1	1/2	12.7	9/16	14.2	5/8	15.8
Area.	sq ins. sq.c.m.	6.4	41.3	7.8	50.3	9.2	59.3	10.6	68.3	12	77.4	13.4	86.4	10.8	95.4
Least Radius of Gyration.	ins. m.m.	1.95	49.5	2.00	50.8	2.04	51.8	2.09	53.0	2.13	54.1	2.18	55.3	2.23	56.6
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	81724	37070	99736	45240	117921	53489	136104	61736	154506	70083	172802	78382	191133	86697
3.5	11.483	80419	36478	98159	44525	116125	52674	134095	60825	152275	69071	170364	77276	188486	85496
4	13.123	79101	35880	96582	43810	114329	51859	132083	59912	150044	68058	167919	76167	185839	84295
4.5	14.764	77783	35282	95005	43095	112533	51044	130071	59000	147813	67045	165479	75060	183192	83094
5	16.404	76465	34684	93428	42380	110737	50229	128059	58088	145582	66032	163039	73953	180545	81893
5.5	18.044	75147	34086	91851	41665	108941	49414	126047	57176	143351	65019	160599	72846	177898	80692
6	19.685	73829	33483	90274	40950	107145	48599	124035	56264	141120	64006	158159	71739	175251	79491
6.5	21.325	72511	32890	88697	40235	105349	47784	122023	55352	138889	62993	155719	70632	172604	78290
7	22.966	71193	32292	87120	39520	103553	46969	120011	54440	136658	61980	153279	69525	169957	77089
7.5	24.606	69875	31694	85543	38805	101757	46154	117999	53528	134427	60967	150839	68418	167310	75888

Table No. 7.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "B2."

Thickness.	ins. m.m.	1/4	63	5/16	7.9	3/8	9.5	7/16	11.1	1/2	12.7	5/8	14.2	3/4	15.8
Area.	sq. ins. sq. c.m.	7.4	47.7	9	58.0	10.6	68.3	12.2	78.7	13.8	89	15.4	99.3	17	109.6
Least Radius of Gyration.	ins. m.m.	2.39	60.7	2.43	61.7	2.48	63	2.52	64	2.57	65.2	2.61	66.2	2.66	67.5
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	96194	43633	117098	53115	138119	62650	159326	72269	180421	81838	201515	91406	222706	101018
3.5	11.483	94975	43080	115643	52455	136435	61886	157417	71404	178301	80876	199192	90352	220193	99878
4	13.123	93756	42527	114188	51795	134751	61124	155510	70540	176181	79913	196869	89298	217680	98738
4.5	14.764	92537	41974	112733	51135	133067	60361	153603	69675	174061	78951	194546	88244	215167	97598
5	16.404	91318	41421	111278	50475	131383	59598	151696	68810	171941	77989	192223	87190	212654	96458
5.5	18.044	90099	40868	109823	49815	129699	58835	149789	67945	169821	77027	189900	86136	210141	95318
6	19.685	88880	40315	108368	49155	128015	58072	147882	67080	167701	76065	187577	85082	207628	94178
6.5	21.325	87661	39762	106913	48495	126331	57309	145975	66215	165581	75103	185254	84028	205115	93038
7	22.966	86442	39209	105458	47835	124647	56546	144068	65350	163461	74141	182931	82974	202602	91898
7.5	24.606	85223	38656	104003	47175	122963	55783	142161	64485	161341	73179	180608	81920	200089	90758
8	26.247	84004	38103	102548	46515	121279	55020	140254	63620	159221	72217	178258	80866	197576	89618
8.5	27.887	82785	37550	101093	45855	119595	54257	138347	62755	157101	71255	175962	79812	195063	88478

Table No. 8.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "C."

Thickness.	ins. m.m.	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
Area.	sq. ins. sq. c.m.	10	63	121	79	141	95	16	111	18	127	199	142	219	158
Least Radius of Gyration.	ins. m.m.	284	64.5	288	78.1	293	91.0	103.2	103.2	116.1	126.4	128.4	141.3	141.3	141.3
Length in metres	Length in feet	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	131514	59654	157985	71661	184522	83698	211057	95734	237629	107787	253648	115053	280352	127166
3.5	11.483	130110	59017	156324	70908	182619	82835	208911	94761	235248	106707	251152	113921	277643	125937
4	13.123	128706	58380	154663	70155	180716	81972	206766	93788	232867	105627	248656	112789	274934	124708
4.5	14.764	127302	57743	153002	69402	178813	81109	204619	92815	230486	104547	246160	111657	272225	123479
5	16.404	125898	57106	151341	68649	176910	80246	202473	91842	228105	103467	243664	110525	269516	122250
5.5	18.044	124494	56469	149680	67896	175007	79383	200327	90869	225724	102387	241168	109393	266807	121021
6	19.685	123090	55832	148019	67143	173104	78520	198181	89896	223343	101307	238672	108261	264098	119792
6.5	21.325	121686	55195	146358	66390	171201	77657	196035	88923	220962	100227	236176	107129	261389	118563
7	22.966	120282	54558	144697	65637	169298	76794	193889	87950	218581	99147	233680	105997	258680	117334
7.5	24.606	118878	53921	143036	64884	167395	75931	191743	86977	216200	98067	231184	104865	255971	116105
8	26.247	117474	53284	141375	64131	165492	75068	189597	86004	213819	96987	228688	103733	253262	114876
8.5	27.887	116070	52647	139714	63378	163589	74205	187451	85031	211438	95907	226192	102601	250553	113647
9	29.528	114666	52010	138053	62625	161686	73342	185305	84058	209057	94827	223696	101469	247844	112418
9.5	31.168	113262	51373	136392	61872	159783	72479	183159	83085	206676	93747	221200	100337	245135	111189
10	32.808	111858	50736	134731	61119	157880	71616	181013	82112	204295	92667	218704	99205	242426	109960
10.5	34.449	110454	50099	133070	60366	155977	70753	178867	81139	201914	91587	216208	98073	239717	108731
11	36.089	109054	49462	131409	59613	154074	69890	176721	80166	199533	90507	213712	96941	237008	107502

Table No. 9.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "C."

Thickness.	ins. m.m.	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Area.	sq. ins. sq. cm.	24.3	17.4	26.6	19.0	28.6	20.6	30.6	22.2	34.8	25.4	39.8	28.5	42.7	31.7	31.7
Least Radius of Gyration.	ins. m.m.	3.16	15.68	3.20	17.16	3.24	18.45	3.29	19.74	3.34	22.45	3.48	25.03	3.57	27.55	27.55
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in Kg.
3	9.842	307031	139267	333748	151385	360567	163551	387421	175732	441074	200068	495128	224585	549082	249059	249059
3.5	11.483	304105	137940	330607	149961	357232	162038	383896	174133	437161	198293	490858	222648	544474	246969	246969
4	13.123	301179	136613	327466	148536	353897	160525	380371	172535	433248	196518	486588	220711	539866	244879	244879
4.5	14.764	298253	135286	324325	147111	350562	159012	376846	170936	429335	194743	482318	218774	535258	242789	242789
5	16.404	295327	133959	321184	145686	347227	157499	373321	169337	425422	192968	478048	216837	530650	240699	240699
5.5	18.044	292401	132632	318043	144261	343892	155986	369796	167738	421509	191193	473778	214900	526042	238609	238609
6	19.685	289475	131305	314902	142836	340557	154478	366271	166139	417596	189418	469508	212963	521434	236519	236519
6.5	21.325	286549	129978	311761	141411	337222	152960	362746	164540	413683	187643	465238	211026	516826	234429	234429
7	22.966	283623	128651	308620	139986	333887	151447	359221	162941	409770	185868	460968	209089	512218	232339	232339
7.5	24.606	280697	127324	305479	138561	330552	149934	355696	161342	405857	184093	456698	207152	507610	230249	230249
8	26.247	277771	125997	302338	137136	327217	148421	352171	159743	401944	182318	452428	205215	503002	228159	228159
8.5	27.887	274845	124670	299197	135711	323882	146908	348648	158144	398031	180543	448158	203278	498394	226069	226069
9	29.528	271919	123343	296056	134286	320547	145395	345121	156545	394118	178768	443888	201341	493786	223979	223979
9.5	31.168	268993	122016	292915	132861	317212	143882	341596	154946	390205	176993	439618	199404	489178	221889	221889
10	32.808	266067	120689	289774	131436	313877	142369	338071	153347	386292	175218	435348	197467	484570	219799	219799
10.5	34.449	263141	119362	286633	130011	310542	140856	334546	151748	382379	173443	431078	195530	479962	217709	217709
11	36.089	260215	118035	283492	128586	307207	139343	331021	150149	378466	171668	426808	193593	475354	215619	215619

Table No. 10.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "E."

Thickness.	ins. m.m.	1/4	3/16	1/2	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	2
Area	sq.ins. sq.cm	16.5	63	191	79	217	95	247	111	276	127	306	142	335	158	2161	2161
Least Radius of Gyration.	ins. m.m.	4.20	106.6	4.25	107.9	4.29	108.9	4.34	110.2	4.38	111.3	4.43	112.5	4.48	113.7	113.7	113.7
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	221584	100509	256701	116438	291605	132270	332203	150685	371139	168347	411790	186785	451215	204668	204668	204668
3.5	11.483	220037	99807	254931	115636	289614	131367	329963	149669	368663	167223	409072	185552	448270	203332	203332	203332
4	13.123	218490	99105	253161	114832	287623	130464	327723	148653	366187	166100	406354	184319	445325	201996	201996	201996
4.5	14.764	216943	98403	251391	114029	285632	129561	325483	147637	363711	164977	403636	183086	442380	200660	200660	200660
5	16.404	215396	97701	249621	113226	283641	128658	323243	146621	361235	163854	400918	181853	439435	199324	199324	199324
5.5	18.044	213849	96999	247851	112423	281650	127755	321003	145605	358759	162731	398200	180620	436490	197988	197988	197988
6	19.685	212302	96297	246081	111620	279659	126852	318763	144589	356283	161608	395482	179387	433345	196652	196652	196652
6.5	21.325	210755	95595	244311	110817	277668	125949	316523	143573	353807	160485	392764	178154	430600	195316	195316	195316
7	22.966	209208	94893	242541	110014	275677	125046	314283	142557	351331	159362	390046	176921	427655	193980	193980	193980
7.5	24.606	207661	94191	240771	109211	273686	124143	312043	141541	348865	158239	387328	175688	424710	192644	192644	192644
8	26.247	206114	93489	239001	108408	271695	123240	309803	140525	346379	157116	384610	174455	421765	191308	191308	191308
8.5	27.887	204567	92787	237231	107605	269704	122337	307563	139509	343903	155993	381892	173222	418820	189972	189972	189972
9	29.528	203020	92085	235461	106802	267713	121434	305323	138493	341427	154870	379174	171989	415875	188636	188636	188636
9.5	31.168	201473	91383	233691	105999	265722	120531	303083	137477	338951	153747	376456	170756	412930	187300	187300	187300
10	32.808	199926	90681	231921	105196	263731	119628	300843	136461	336475	152624	373738	169523	409985	185964	185964	185964
10.5	34.449	198379	89979	230151	104393	261740	118725	298603	135445	333999	151501	371020	168290	407040	184628	184628	184628
11	36.089	196832	89277	228381	103590	259749	117822	296363	134429	331523	150378	368302	167057	404095	183292	183292	183292
11.5	37.730	195285	88575	226611	102787	257758	116919	294123	133413	329047	149255	365584	165824	401150	181956	181956	181956
12	39.370	193738	87873	224841	101984	255767	116016	291883	132397	326571	148132	362866	164591	399205	180620	180620	180620

Table No. 11.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "E."

Thickness	ins. m.m.	1/16	1/4	3/4	1/2	3/16	7/8	1	1 1/8	1 1/4	1 3/4				
Area	sq.ins. sq.c.m.	364	174	40	190	43	206	459	222	517	254	576	285	635	317
Least Radius of Gyration	ins. m.m.	452	2347	456	258	461	2774	466	2961	473	3335	484	3715	493	4096
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	490240	222368	539088	244526	579866	263024	619191	280864	697797	316517	777969	352880	858327	389329
3.5	11.483	487075	220932	535642	242963	576189	261356	615313	279104	693494	314565	773284	350755	853258	387030
4	13.123	483910	219496	532196	241400	572512	259688	611435	277345	689191	312613	768599	348630	848189	384731
4.5	14.764	480745	218060	528750	239837	568835	258020	607557	275586	684888	310661	763914	346505	843120	382432
5	16.404	477580	216624	525304	238274	565158	256352	603679	273827	680583	308709	759229	344380	838051	380133
5.5	18.044	474415	215188	521858	236711	561481	254684	599801	272068	676282	306757	754544	342255	832982	377834
6	19.685	471250	213752	518412	235148	557804	253016	595923	270309	671979	304805	749859	340130	827913	375535
6.5	21.325	468085	212316	514966	233585	554127	251348	592045	268550	667676	302853	745174	338005	822844	373236
7	22.966	464920	210880	511520	232022	550450	249680	588167	266791	663373	300901	740489	335880	817775	370937
7.5	24.606	461755	209444	508074	230459	546773	248012	584287	265032	659070	298949	735804	333755	812706	368638
8	26.247	458590	208008	504628	228896	543096	246344	580411	263273	654767	296997	731119	331630	807637	366339
8.5	27.887	455425	206572	501182	227333	539419	244676	576533	261514	650464	295045	726434	329505	802566	364040
9	29.528	452260	205136	497736	225770	535742	243008	572655	259755	646161	293093	721749	327380	797499	361741
9.5	31.168	449095	203700	494290	224207	532065	241340	568777	257996	641858	291141	717064	325255	792430	359442
10	32.808	445930	202264	490844	222644	528388	239672	564899	256237	637555	289189	712379	323130	787361	357143
10.5	34.449	442765	200828	487398	221081	524711	238004	561021	254478	633252	287237	707694	321005	782292	354844
11	36.089	439600	199392	483952	219518	521034	236336	557143	252719	628949	285285	703009	318880	777223	352545
11.5	37.730	436435	197956	480506	217955	517357	234668	553265	250960	624646	283333	698324	316755	772154	350246
12	39.370	433270	196520	477060	216392	513680	233000	549387	249201	620343	281381	693639	314630	767085	347947

Table No. 12.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "G."

Thickness.	ins. m.m.	5/16	7/16	3/8	9/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 5/8	2	2 1/4
Area.	sq.ins. sq.cm.	242	156.1	28.1	181.2	32	206.4	36	232.2	39.9	257.4	43.8	282.5	47.7	307.7
Least Radius of Gyration.	ins. m.m.	5.54	140.7	5.59	141.9	5.64	143.2	5.68	144.2	5.73	145.5	5.77	146.5	5.82	147.8
Length in feet.	Length in metres.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	328387	148954	381289	172950	435322	197459	488854	221739	542053	245871	595032	269903	648284	294057
3.5	11.483	326667	148174	379311	172053	433025	196417	486358	220607	539313	244628	592043	268547	645059	292594
4	13.123	324947	147394	377333	171156	430728	195375	483862	219475	536573	243385	589084	267191	641834	291131
4.5	14.764	323227	146614	375355	170259	428431	194333	481366	218343	533833	242142	586065	265835	638609	289668
5	16.404	321507	145834	373377	169362	426134	193291	478870	217211	531093	240899	583076	264479	635384	288205
5.5	18.044	319787	145054	371399	168465	423837	192249	476374	216079	528353	239656	580087	263123	632159	286742
6	19.685	318067	144274	369421	167568	421540	191207	473878	214947	525613	238413	577098	261767	628934	285279
6.5	21.325	316347	143494	367443	166671	419243	180165	471382	213815	522873	237170	574109	260411	625709	283816
7	22.966	314627	142714	365465	165774	416946	189123	468886	212683	520133	235927	571120	259055	622484	282353
7.5	24.606	312907	141934	363487	164877	414649	188081	466390	211551	517393	234684	568131	257639	619259	280890
8	26.247	311187	141154	361509	163980	412352	187039	463894	210419	514653	233441	565142	256343	616034	279427
8.5	27.887	309467	140374	359531	163083	410055	185997	461398	209287	511913	232198	562153	254987	612809	277964
9	29.528	307747	139594	357553	162186	407758	184955	458902	208155	509173	230955	559164	253631	609584	276501
9.5	31.168	306027	138814	355575	161289	405461	183913	456406	207023	506433	229712	556175	252275	606359	275038
10	32.808	304307	138034	353597	160392	403164	182871	453910	205891	503693	228469	553186	250919	603134	273575
10.5	34.449	302587	137254	351619	159495	400867	181829	451414	204759	500953	227226	550197	249563	599909	272112
11	36.089	300867	136474	349641	158598	398570	180787	448918	203627	498213	225983	547208	248207	596684	270649
11.5	37.730	299147	135694	347663	157701	396273	179745	446422	202495	495473	224740	544219	246851	593459	269186
12	39.370	297427	134914	345685	156804	393976	178703	443926	201363	492733	223497	541230	245495	590234	267723

Table No. 13.

*Safe Loads in Kilograms and Pounds for Phoenix Steel Columns.
For Columns with Square End Bearings.*

Segments "G."

Thickness.	ins. m.m.	3/4	190 ○	13/16	206	7/8	222	1	254	1 1/8	285	1 1/4	317	1 3/8	349
Area.	sq.ins. sq.cm.	51.7	333.5	556	3587	596	3845	674	4348	753	4857	831	5361	909	5864
Least Radius of Gyration.	ins. m.m.	5.88	149.3	591	150.1	595	151.1	604	153.4	613	155.6	627	159.2	632	160.5
Length in metres.	feet.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
3	9.842	702848	318808	756175	342896	810617	367691	917060	415974	1024842	464859	1131911	513425	1238390	561724
3.5	11.483	699387	317238	752482	341321	806689	365910	912668	413982	1020005	462665	1126692	511058	1232725	559156
4	13.123	695926	315668	748789	339646	802763	364129	908277	411990	1015168	460471	1121474	508691	1227060	556588
4.5	14.764	692465	314098	745096	337971	798837	362348	903885	409998	1010331	458277	1116256	506324	1221395	554020
5	16.404	689004	312528	741403	336296	794911	360567	899493	408006	1005494	456083	1111038	503957	1215730	551452
5.5	18.044	685543	310958	737710	334621	790985	358786	895101	406014	1000657	453889	1105820	501590	1210065	548884
6	19.685	682082	309388	734017	332946	787059	357005	890709	404022	995820	451695	1100602	499223	1204400	546316
6.5	21.325	678621	307818	730324	331271	783133	355224	886317	402030	990983	449501	1095384	496856	1198735	543748
7	22.966	675160	306248	726631	329596	779207	353443	881925	400038	986146	447307	1090166	494489	1193070	541180
7.5	24.606	671699	304678	722938	327921	775281	351662	877533	398046	981309	445113	1084948	492122	1187405	538612
8	26.247	668238	303108	719245	326246	771355	349881	873141	396054	976472	442919	1079730	489755	1181740	536044
8.5	27.887	664777	301538	715552	324571	767429	348100	868749	394062	971635	440725	1074512	487388	1176075	533476
9	29.528	661316	299968	711859	322896	763503	346319	864357	392070	966798	438531	1069294	485021	1170410	530908
9.5	31.168	657855	298398	708166	321221	759577	344538	859965	390078	961961	436337	1064076	482654	1164745	528340
10	32.808	654394	296828	704473	319546	755651	342757	855573	388086	957124	434143	1058858	480287	1159080	525772
10.5	34.449	650933	295258	700780	317871	751725	340976	851181	386094	952287	431959	1053640	477920	1153415	523204
11	36.089	647472	293688	697087	316196	747799	339195	846789	384102	947450	429765	1048422	475553	1147750	520636
11.5	37.730	644011	292118	693394	314521	743873	337414	842397	382110	942613	427571	1043204	473186	1142085	518068
12	39.370	640550	290548	689701	312846	739947	335633	838005	380118	937776	425377	1037986	470819	1136420	515500

Table No. 14.

Table of Safe Loads for 12" (304.8 m.m.) Z-Bar Columns.

Allowed stresses per sq. in. (12,000 lbs. for lengths of 90 radii or under.
safety factor 4: (17,100-57) for lengths over 90 radii.

Allowed stresses per sq. cm. (843.7 Kgs. for lengths of 90 radii or under.
safety factor 4: (17,100-57) for lengths over 90 radii.

Thickness.	ins. m.m.	3/8	9.5	1/2	12.7	5/8	15.8	3/4	19	7/8	22.2
Weight.	lbs. per ft. Kg. per M.	72.7	108.2	97.8	145.5	118.5	176.3	137.8	205.1	162.1	241.2
Area.	sq. ins. sq. cm.	21.4	138.0	28.8	185.8	34.8	224.5	40.5	261.2	47.70	307.7
Least Radius of Gyration.	ins. m.m.	3.67	93.2	3.77	95.1	3.75	95.2	3.68	93.4	3.64	92.4
Length in metres.	Length in feet	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.
8	26.247	256681	116430	345591	156759	417573	189410	485836	220374	572327	259606
8.5	27.887	254543	115460	345591	156759	417573	189410	482258	218751	565446	256485
9	29.528	248004	112494	336948	152839	407482	184833	469912	213151	550742	249815
9.5	31.168	241467	109529	328375	148950	397066	180108	457566	207551	536038	243144
10	32.808	234930	106564	319802	145061	386650	175383	445220	201951	521334	236474
10.5	34.449	228393	103599	311229	141172	376234	170658	432874	196351	506630	229804
11	36.089	221856	100634	302656	137283	365818	165933	420528	190751	491926	223134
11.5	37.729	215319	97669	294083	133394	355402	161208	408182	185151	477222	216464
12	39.370	208782	94704	285510	129505	344986	156483	395836	179551	462518	209794
12.5	41.010	202245	91739	276937	125616	334570	151758	383490	173951	447814	203124

Table No. 15.

Table of Safe Loads for 10" (254 m.m.) Z-Bar Columns.

Allowed stresses per sq in. (12000 lbs. for lengths of 90 radii or under.
safety factor 4:
(17100-57) for lengths over 90 radii.

Allowed stresses per sq c.m. (8437 Kgs. for lengths of 90 radii or under.
safety factor 4:
(10703 (17100-57)) for lengths over 90 radii.

Thickness	ins. m.m.	5/16	7/8	7/16	11/16	9/16	1/2	11/16	13/16	20/16
Weight	lbs per ft. Kg per M.	53.7	79.9	75.8	112.8	94.2	140.3	111	165.2	197.3
Area	sq ins. sq c.m.	15.8	101.9	22.3	143.8	27.7	178.7	32.7	210.9	251.6
Least Radius of Gyration	ins. m.m.	3.08	78.2	31.8	80.7	31.5	80	31.3	79.5	82.5
Length in metres	Length in feet	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in lbs.	Safe Load in Kg.	Safe Load in Kg.
7	22.966	189536	85973	267470	121324	332375	150769	392277	177936	467901
7.5	24.606	183720	83335	263039	119314	325595	147689	383166	173803	464736
8	26.247	177966	80725	255171	115745	315727	143213	371446	168487	451266
8.5	27.887	172212	78115	247303	112175	305859	138738	359726	163171	437796
9	29.528	166458	75505	239435	108605	295991	134263	348006	157855	424326
9.5	31.168	160704	72895	231567	105035	286123	129788	336286	152539	410856
10	32.808	154950	70285	223699	101465	276255	125313	324566	147223	397386
10.5	34.449	149196	67675	215831	97895	266387	120838	312846	141907	383916
11	36.089	143442	65065	207963	94325	256519	116363	301126	136591	370446
11.5	37.729	137688	62455	200095	90755	246651	111888	289406	131275	356976
12	39.370	131934	59845	192227	87185	236783	107413	277686	125959	343506
12.5	41.010	126180	57235	184359	83615	226915	102938	265966	120643	330036

Table No. 16.

Table of Safe Loads for 8(203.2 m.m.) Z-Bar Columns.

Allowed stresses per sq. in. (12000 lbs. for lengths of 90 radii or under.
safety factor 4:
(17100-57) for lengths over 90 radii.

Allowed stresses per sq. cm. (8437 Kgs. for lengths of 90 radii or under.
safety factor 4:
(10703 (17100-57)) for lengths over 90 radii.

Thickness.	ins. m.m.	1/4	3/8	1/2	5/8	3/4	19
Weight.	lbs. per ft. Kgs. per M.	383	57	863	1096	1327	1613
Area.	sq. ins. sq. cm.	113	729	1103	1412	1696	2058
Least Radius of Gyration.	ins. m.m.	2.47	627	2.57	652	2.55	647
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.
5.5	18.045	135594	61505	205160	93060	262634	119130
6	19.685	131575	59682	202649	91921	258681	117337
6.5	21.325	126443	57354	195177	88532	249038	112963
7	22.966	121311	55026	187705	85143	239395	108588
7.5	24.606	116179	52698	180233	81754	229752	104214
8	26.247	111047	50370	172761	78365	220109	99840
8.5	27.887	105915	48042	165289	74976	210466	95466
9	29.528	100783	45714	157817	71587	200823	91092
9.5	31.168	95651	43386	150345	68198	191180	86718
10	32.809	90519	41058	142873	64809	181537	82344
10.5	34.449	85387	38730	135401	61420	171894	77970
11	36.089	80255	36402	127929	58031	162251	73596
11.5	37.729	75123	34074	120457	54642	152608	69222
12	39.370	69991	31746	112985	51253	142965	64848

Table No. 17.

Table of Safe Loads for 6" (152.39 m.m.) Z-Bar Columns.

Allowed stresses per sq.in. { 12,000 lbs. for lengths of 90 radii or under.
safety factor 4: { 17,100-57½ for lengths over 90 radii.

Allowed stresses per sq.c.m. { 8437 Kgs. for lengths of 90 radii or under.
safety factor 4: { 10703 (17,100-57½) for lengths over 90 radii.

Thickness.	ins. m.m.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
Weight.	lbs. per ft. Kgs. per M.	31.7	47.2	59.2	68.7	80.8	89.1	101	113.5	129	142	154	166
Area.	sq. ins. sq. c.m.	9.31	13.6	16.8	19.3	22.4	25.5	28.6	31.7	34.8	37.9	41.0	44.1
Least Radius of Gyration.	ins. m.m.	1.86	2.79	3.54	4.08	4.77	5.46	6.15	6.84	7.53	8.22	8.91	9.60
Length in metres.	Length in feet.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.	Safe Load in lbs.	Safe Load in Kgs.
4	13.123	111600	50621	140245	63615	163122	73992	191954	87070	211112	95760	239942	108837
4.5	14.764	108479	49206	137639	62433	159333	72278	189778	86083	207190	93981	238280	108083
5	16.404	102864	46659	130730	59289	151213	68590	180475	81863	196789	89263	226767	102861
5.5	18.044	97249	44112	123821	56165	143093	64907	171173	77643	186388	84545	215254	97639
6	19.685	91634	41565	116912	53031	134973	61224	161870	73423	175987	79827	203741	92417
6.5	21.325	86019	39018	110003	49897	126853	57541	152567	69203	165586	75109	192228	87195
7	22.966	80404	36471	103094	46763	118733	53858	143264	64983	155185	70391	180715	81973
7.5	24.606	74789	33924	96185	43629	110613	50175	133961	60763	144784	65673	169202	76751
8	26.247	69174	31377	89276	40495	102493	46492	124658	56543	134383	60955	157689	71529
8.5	27.887	63559	28830	82367	37361	94373	42809	115355	52323	123982	56237	146176	66307
9	29.528	57944	26283	75458	34227	86253	39126	106052	48103	113581	51519	134663	61085

Table No. 18.

*Safe Loads in Thousands of Kilograms and Pounds
for
Round Cast Iron Columns.*

Allowed stresses in lbs. per sq. inch. $\left\{ 1 + \frac{10000}{L^2} \right.$
Factor of Safety 8. $\left. \frac{703}{800 d^2} \right.$

d = diam. in inches.
 L = length in inches.

14" Outside diam. of Column 355.6 m.m.

Area.	sq.ins	2635	408	3231	501	380	589	4345	673	4864	754
	sq.cm		1		1 1/4		1 1/2		1 3/4		2
Thickness	ins.	25.4		31.7		31.8		44.44		50.8	
	m.m.										
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	K'gs.	lbs.	K'gs.	lbs.	K'gs.	lbs.	K'gs.	lbs.	K'gs.	lbs.
4	13.123	160	353	196	432	231	509	264	582	295	651
4.5	14.764	154	340	189	417	223	491	255	561	285	628
5	16.404	149	328	182	402	214	472	245	540	274	605
5.5	18.044	143	314	175	385	206	454	235	519	263	580
6	19.685	137	301	168	369	197	434	225	497	252	556
6.5	21.325	131	289	161	354	189	417	216	477	242	534
7	22.966	125	275	153	337	180	397	206	454	230	508
7.5	24.606	119	263	147	323	172	379	196	433	220	485
8	26.247	114	250	139	307	164	360	187	413	210	462
8.5	27.887	108	238	133	292	156	344	178	393	200	440

Allowed stresses in Kilos. persq. c.m. $\left\{ 1 + \frac{703}{L^2} \right.$
Factor of Safety 8. $\left. \frac{703}{800 d^2} \right.$

d = diam. in metres.
 L = length in metres.

15" Outside diam. of Column 381 m.m.

Area.	sq. ins.		44		54		636		728		816
	sq. cm.	2838		3484		4104		470		5269	
Thickness	ins.	1		1 1/4		1 1/2		1 3/4		2	
	m.m.	25.4		31.7		38.1		44.4		50.8	
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
4	13.123	175	387	215	475	254	559	290	640	326	718
4.5	14.764	170	375	209	460	246	542	281	620	316	696
5	16.404	163	362	202	444	238	524	272	599	305	672
5.5	18.044	158	349	194	428	229	505	262	578	294	648
6	19.685	152	336	187	413	220	486	252	556	283	624
6.5	21.325	146	323	180	396	212	467	242	534	272	599
7	22.966	140	309	172	380	203	447	232	512	260	574
7.5	24.606	134	296	165	364	194	429	223	491	250	550
8	26.247	129	284	158	348	186	410	213	470	239	527
8.5	27.887	123	271	151	333	178	392	204	449	228	504
9	29.527	118	259	144	318	170	375	194	429	218	481

Table No. 19.

Safe Loads in Thousands of Kilograms and Pounds for Round Cast Iron Columns.

Allowed stresses in lbs. per sq. inch. $\left\{ 1 + \frac{10000}{L^2} \right.$
Factor of Safety 8. $\left. \frac{L^2}{800 d^2} \right\}$

d = diam. in inches.
L = length in inches.

Allowed stresses in Kilos. per sq. c. m. $\left\{ \frac{203}{L^2} \right.$
Factor of Safety 8. $\left. \frac{L^2}{800 d^2} \right\}$

d = diam. in metres.
L = length in metres.

12" Outside diam. of Column. 304.8 m.m.

Area	sq. ins.	171.0	265	346	422	495	564	628						
sq. c. m.														
Thickness	ins.	3/4	1	1 1/4	1 1/2	1 3/4	2							
m. m.		190	254	317	381	444	508							
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		
Metres	Feet	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	
3.5	11.483	104	228	135	297	164	362	193	425	219	484	245	539	
4	13.123	99	218	129	284	158	347	185	407	210	464	235	517	
4.5	14.764	95	208	123	272	151	332	176	389	201	443	224	494	
5	16.404	90	198	117	259	143	316	168	370	191	422	213	470	
5.5	18.044	86	188	111	246	136	300	160	352	182	401	203	447	
6	19.685	81	179	106	233	129	284	151	333	172	380	192	423	
6.5	21.325	76	169	100	221	122	269	143	315	163	359	181	401	
7	22.966	73	160	95	208	115	254	135	298	154	340	172	379	
7.5	24.606	68	151	89	197	109	240	128	282	146	321	162	358	
8	26.247	65	143	84	186	103	227	121	266	131	303	153	338	

13" Outside diam. of Column. 330.2 m.m.

Area	sq. ins.	243.2	377	461	542	619	691							
sq. c. m.														
Thickness	ins.	1	1 1/4	1 1/2	1 3/4	2								
m. m.		254	317	381	444	508								
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		
Metres	Feet	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	
4	13.123	145	319	177	390	208	458	237	523	264	584			
4.5	14.764	139	306	170	375	200	440	228	502	254	561			
5	16.404	133	293	163	359	191	421	218	481	244	537			
5.5	18.044	127	280	155	343	183	402	208	459	233	514			
6	19.685	121	267	148	327	174	384	199	438	222	489			
6.5	21.325	115	254	141	311	166	365	189	417	211	466			
7	22.966	110	241	134	296	157	347	180	396	201	443			
7.5	24.606	104	229	127	281	149	330	171	376	191	420			
8	26.247	99	217	121	266	142	313	161	357	181	390			
8.5	27.887	94	206	115	252	134	296	154	338	167	378			

Table No. 20.

Safe Loads in Thousands of Kilograms and Pounds for Round Cast Iron Columns.

Allowed stresses in lbs. per sq. inch. $1 + \frac{10000}{800 d^2}$
Factor of Safety 8.

d = diam. in inches.
 l = length in inches.

10" Outside diam. of Column. 254 m.m.

Area	sq ins sq cm	1406	218	1826	283	2213	343	258	40	2925	4535	3238	502
Thickness	ins. mm.	19	3/4	254	1	317	1 1/4	381	1 1/2	444	1 3/4	508	2
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres	Feet	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
3.5	11.483	80	176	104	229	126	277	146	323	166	366	184	405
4	13.123	75	167	98	216	119	262	139	306	157	347	174	384
4.5	14.764	71	157	92	203	112	247	130	288	148	326	164	361
5	16.404	67	147	86	191	105	231	122	269	138	305	153	338
5.5	18.044	62	137	81	178	98	216	114	252	129	286	143	316
6	19.685	58	128	76	167	92	202	107	236	121	267	134	296
6.5	21.325	54	120	71	156	86	189	100	220	113	249	125	276
7	22.966	51	112	66	145	80	176	93	205	105	232	117	257
7.5	24.606	47	104	61	136	74	164	87	192	98	217	109	240
8	26.247	44	97	57	126	69	153	81	179	92	202	102	224

Allowed stresses in Kilos per sq. c.m. $1 + \frac{703}{800 d^2}$
Factor of Safety 8.

d = diam. in metres.
 l = length in metres.

11" Outside diam. of Column. 279.4 m.m.

Area.	sq.ins. sq.cm.	155.5	241	2026	314	2471	383	448	509	3645	565		
Thickness	ins. m.m.	19	¾	254	1	317	1¼	381	1½	444	1¾	508	2
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
3.5	11.483	91	202	119	263	145	320	170	375	193	426	214	473
4	13.123	87	192	113	250	138	305	162	357	184	406	204	450
4.5	14.764	83	182	108	237	131	289	153	338	174	384	194	427
5	16.404	78	172	102	224	124	274	145	320	165	364	183	404
5.5	18.044	74	162	96	211	117	258	137	302	155	343	173	380
6	19.685	69	153	90	199	110	243	129	284	146	323	162	358
6.5	21.325	65	144	85	187	104	228	121	267	138	303	153	337
7	22.966	61	135	80	176	97	214	114	251	129	285	143	316
7.5	24.606	58	127	75	166	92	202	107	236	122	268	135	298
8	26.247	54	119	70	155	86	189	100	222	114	252	127	279
8.5	27.887	51	112	66	146	81	178	94	208	107	236	119	262

Table No. 21.

Safe Loads in Thousands of Kilograms and Pounds

for Round Cast Iron Columns.

Allowed stresses in lbs. per sq. inch
Factor of Safety 8

$$1 + \frac{10000}{800 d^2}$$

d = diam. in inches.
l = length in inches.

8" Outside diam. of Column. 203.2 m.m.

Area.	sq ins sq cm	110.3	17 1/4	22	26.5	30.6	34.3	37.7	
Thickness	ins m.m.	19	3/4	1	1 1/4	1 1/2	1 3/4	2	
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
2.5	8.202	65.2	143.8	83.9	185.0	101.1	222.9	116.8	257.3
3	9.842	61.1	134.6	78.6	173.2	94.6	208.7	109.3	240.9
3.5	11.483	56.6	124.9	72.9	160.7	87.8	193.6	101.4	223.5
4	13.123	52.3	115.5	67.4	148.6	81.2	179.0	93.7	206.7
4.5	14.764	48.2	106.2	61.9	136.6	74.6	164.6	86.2	190.1
5	16.404	44.3	97.3	56.8	125.2	68.4	150.9	79.0	174.2
5.5	18.044	40.6	89.5	52.2	115.2	62.9	138.7	72.6	160.2
6	19.685	37.1	81.9	47.8	105.4	57.6	127.0	66.5	146.6

Allowed stresses in Kilos per sq. c.m.
Factor of Safety 8

$$1 + \frac{703}{800 d^2}$$

d = diam. in metres.
l = length in metres.

9" Outside diam. of Column. 228.6 m.m.

Area	sq. ins. sq. cm.	125.1	19.4	25.1	30.4	35.3	39.9	44	
Thickness	ins. m.m.	19	3/4	1	1 1/4	1 1/2	1 3/4	2	
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
3	9.842	72.4	159.8	93.8	206.7	113.6	250.4	131.9	290.8
3.5	11.483	68.1	150.2	88.1	192.3	106.7	235.3	123.9	273.2
4	13.123	63.6	140.4	82.4	181.6	99.8	220.0	115.8	255.4
4.5	14.764	59.2	130.6	76.7	169.0	92.9	204.7	107.8	237.7
5	16.404	55.0	121.2	71.2	156.9	86.2	190.0	100.1	220.6
5.5	18.044	51.1	112.8	66.2	145.9	80.1	176.7	93.1	205.2
6	19.685	47.4	104.4	61.3	135.1	74.3	163.6	86.2	190.0
6.5	21.325	43.8	96.6	56.7	125.0	68.6	151.4	79.7	175.8
7	22.966	40.5	89.4	52.4	115.7	63.5	140.1	73.7	162.7
7.5	24.606	37.5	82.8	48.6	107.1	58.8	129.7	68.3	150.6

Table No. 22.

Allowed stresses in lbs. per sq. inch.
Factor of Safety 8

$$1 + \frac{10000}{800 d^2}$$

d = diam. in inches.
L = length in inches.

*Safe Loads in Thousands of Kilograms and Pounds
for
Round Cast Iron Columns.*

6" Outside diam. of Column. 152.4 m.m.

Area.	sq ins. sq.c.m.	55.48	86	80	124	157	186	136.77	212
Thickness.	ins. m.m.	12.7	1/2"	19	3/4	1	1 1/4	38.1	1 1/2
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
2	6.561	321	707	462	1020	585	1291	694	1529
2.5	8.202	292	644	421	928	533	1175	631	1392
3	9.842	264	581	380	838	481	1061	570	1257
3.5	11.483	236	520	340	749	430	949	510	1124
4	13.123	210	462	302	666	383	843	453	999
4.5	14.764	187	411	269	593	341	751	404	890
5	16.404	166	367	240	529	304	669	360	793

Allowed stresses in Kilos. per sq.c.m.
Factor of Safety 8:

$$1 + \frac{703}{800 d^2}$$

d = diam. in metres.
L = length in metres.

7" Outside diam. of Column. 177.7 m.m.

Area.	sq ins. sq.c.m.	948	147	1083	168	1219	189	1451	225	1668	259
Thickness.	ins. m.m.	19	3/4	222	7/8	254	1	317	1 1/4	38.1	1 1/2
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
2.5	8.202	534	1178	611	1346	687	1514	818	1803	941	2075
3	9.842	491	1083	561	1238	632	1393	752	1658	866	1908
3.5	11.483	449	990	513	1131	577	1273	687	1515	791	1744
4	13.123	408	900	466	1029	525	1157	625	1378	719	1586
4.5	14.764	370	817	423	933	476	1050	567	1250	650	1439
5	16.404	335	741	383	845	431	951	513	1131	593	1308
5.5	18.044	304	670	347	766	391	862	465	1026	536	1181

Table No. 23.

*Safe Loads in Thousands of Kilograms and Pounds
for
Square Cast Iron Columns.*

Allowed stresses in lbs. per sq. inch $\left\{ \frac{10000}{1 + \frac{3L^2}{3200S^2}} \right\}$
Factor of Safety 8.

L = length in inches.
 S = width of side in inches.

Allowed stresses in Kilos. per sq. c.m. $\left\{ \frac{703}{1 + \frac{3L^2}{3200S^2}} \right\}$
Factor of Safety 8.

L = length in metres.
 S = width of side in metres.

14" □ Outside 355.6 m.m.

Area	sq ins sq cm	335.5	52	411.3	63.75	483.9	75	553.2	85.75	619.4	96
Thickness	ins mm	25.4	1	31.7	1¼	38.1	1½	44.4	1¾	50.8	2
Length.		Safe Load		Safe Load		Safe Load		Safe Load		Safe Load.	
Metres	Feet	Kgs	lbs.	Kgs	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
4	13 123	211	465	285	570	304	671	348	767	389	858
4.5	14 764	205	452	251	554	296	652	338	746	379	835
5	16 404	199	439	244	538	287	633	328	724	367	810
5.5	18 044	193	425	236	521	278	613	318	701	356	784
6	19 685	186	411	228	503	269	592	307	677	344	758
6.5	21 325	180	396	220	486	259	571	296	653	332	731
7	22 966	173	382	212	468	250	550	285	629	319	704
7.5	24 606	167	367	204	450	240	529	275	605	307	678
8	26 247	160	353	196	432	231	509	264	582	295	651
8.5	27 887	154	339	188	414	222	488	253	559	284	625

15" □ Outside 381 m.m.

Area.	sq ins sq cm	361.3	56	443.5	68.75	522.6	81	598.4	92.75	671	104
Thickness	ins m.m.	25.4	1	31.7	1¼	38.1	1½	44.44	1¾	50.8	2
Length.		Safe Load		Safe Load		Safe Load		Safe Load		Safe Load	
Metres	Feet	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
4	13.123	230	508	283	623	333	734	381	841	428	943
4.5	14.764	225	495	276	608	325	716	372	820	417	920
5	16.404	219	482	269	592	316	697	362	799	406	896
5.5	18.044	213	469	261	575	307	678	352	776	395	870
6	19.685	206	454	253	558	298	657	341	753	383	844
6.5	21.325	200	440	245	540	289	636	331	729	369	813
7	22.966	193	426	237	522	279	615	320	705	359	790
7.5	24.606	186	411	229	504	270	594	309	680	346	763
8	26.247	180	396	221	486	260	573	298	656	334	736
8.5	27.887	173	382	213	469	251	552	287	633	322	709
9	29.528	167	368	205	451	241	532	276	609	310	683

Table No. 24.

Safe Loads in Thousands of Kilograms and Pounds for

Square Cast Iron Columns.

Allowed stresses in lbs. per sq. inch.
Factor of Safety 8.

$$\left\{ 1 + \frac{10000}{3200 S^2} \right\}$$

L = length in inches.
S = width of side in inches.

Allowed stresses in Kilos. per sq. c.m.
Factor of Safety 8.

$$\left\{ 1 + \frac{703}{3200 S^2} \right\}$$

L = length in metres.
S = width of side in metres.

12" □ Outside 304 m.m.

Area.	sq. ins.	sq. c.m.	2177	3375	44	2838	3467	5375	4064	63	4629	7175	5161	80
Thickness.	ins.	m.m.	19	3/4	1	3/4	1 1/4	3/4	3/4	1 1/2	444	1 1/4	508	2
Length.			Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	
3.5	11.483	136	300	178	392	217	478	254	561	290	639	323	712	
4	13.123	132	291	172	379	210	463	246	543	280	618	312	689	
4.5	14.764	127	280	166	365	203	446	237	523	270	596	301	665	
5	16.404	122	270	159	351	195	429	228	503	260	573	290	639	
5.5	18.044	117	259	153	337	187	412	219	483	250	550	278	613	
6	19.685	112	248	146	323	179	394	210	462	239	526	266	587	
6.5	21.325	107	237	140	309	171	377	200	442	228	503	254	561	
7	22.966	102	226	134	294	163	360	191	422	218	480	243	535	
7.5	24.606	98	215	127	281	155	343	182	402	208	458	231	510	
8	26.247	93	205	121	267	148	327	174	383	198	436	220	487	

13" □ Outside 330.2 m.m.

Area.	sq.ins	48	5875	69	7875	88	9675
	sq.c.m.	3097	379	445.1	508.1	567.7	624.2
Thickness	ins.	1	1 1/4	1 1/2	1 3/4	2	2 1/4
	m.m.	254	3175	381	444	508	571
Length.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
4	13.123	191	422	234	517	275	607
4.5	14.764	185	409	227	500	267	588
5	16.404	179	395	219	484	258	568
5.5	18.044	173	381	212	466	248	548
6	19.685	166	367	204	449	239	527
6.5	21.325	160	352	196	431	230	506
7	22.966	153	338	188	413	220	486
7.5	24.606	147	324	180	396	211	465
8	26.247	141	310	172	379	202	445
8.5	27.887	134	296	164	362	193	425

Table No. 25.

Safe Loads in Thousands of Kilograms and Pounds for

Square Cast Iron Columns.

Allowed stresses in lbs. per sq. inch.
Factor of Safety 8.

$$1 + \frac{10000}{3200 S^2}$$

L = length in inches.
S = width of side in inches.

Allowed stresses in Kilos. per sq. c.m.
Factor of Safety 8.

$$1 + \frac{703}{3200 S^2}$$

L = length in metres.
S = width of side in metres.

10" □ Outside 254 m.m.

Area	sq.ins. sq.c.m.	179	2775	2322	36	28226	4375	51	5776	4129	64
Thickness	ins. m.m.	19	¾	254	1	317	1¼	1½	1¾	508	2
Length.		Safe Load		Safe Load		Safe Load.		Safe Load		Safe Load	
Metres.	Feet	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
3.5	11.843	107	236	139	306	169	371	196	433	222	490
4	13.123	102	225	133	292	161	355	188	414	213	469
4.5	14.764	97	214	126	278	153	338	179	394	202	446
5	16.404	92	204	120	264	146	321	170	374	192	424
5.5	18.044	87	193	113	250	138	304	161	354	182	401
6	19.685	83	182	107	237	130	287	152	335	172	379
6.5	21.325	78	172	101	223	123	271	143	316	162	358
7	22.966	73	162	95	210	116	256	135	298	153	337
7.5	24.606	69	153	90	198	109	241	127	281	144	318
8	26.247	65	144	85	187	103	227	120	264	136	299

11" □ Outside 279.4 m.m.

Area.	sq. ins. sq. cm.	1984	30.75	2581	40	3145	4875	3677	57	4177	6475	4645	72
Thickness	ins. m.m.	19	¾	254	1	317	1¼	381	1½	444	1¾	508	2
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
3.5	11.843	122	268	158	349	193	425	225	497	256	565	285	628
4	13.123	117	258	152	336	185	409	217	478	246	543	274	604
4.5	14.764	112	247	146	322	178	392	208	459	236	521	263	579
5	16.404	107	237	140	308	170	375	199	438	226	498	251	554
5.5	18.044	102	226	133	293	162	358	190	418	216	475	239	528
6	19.685	97	215	127	279	154	340	180	398	205	452	228	503
6.5	21.325	93	204	120	265	147	323	171	378	195	429	217	477
7	22.966	88	194	114	252	139	307	163	359	185	408	206	453
7.5	24.606	83	184	108	239	132	291	154	340	175	387	195	430
8	26.247	79	174	103	226	125	276	146	323	166	367	185	407
8.5	27.887	75	165	98	214	118	261	139	305	157	347	175	386

Table No. 26.

Safe Loads in Thousands of Kilograms and Pounds for

Square Cast Iron Columns.

Allowed stresses in lbs. per sq. inch. $\left\{ \frac{10000}{1 + \frac{3L^2}{3200S^2}} \right.$
Factor of Safety 8.

L = length in inches.
S = width of side in inches.

8" □ Outside 203 m.m.

Area	sq. ins.	1403	2175	28	1806	2177	3375	2516	39	2823	4375	3097	48
Thickness	ins.	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
Length.	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load
Metres	Feet	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
2.5	8.202	86	190	111	245	134	296	155	341	174	383	191	420
3	9.842	82	181	105	232	127	280	147	324	165	363	181	398
3.5	11.483	77	170	99	219	120	264	139	305	155	343	171	376
4	13.123	72	159	93	205	112	247	130	286	146	321	160	352
4.5	14.764	68	149	87	192	105	232	121	268	136	300	149	330
5	16.404	63	139	81	179	98	215	113	249	127	279	139	306
5.5	18.044	58	129	75	166	91	200	105	231	118	259	129	284
6	19.685	54	120	70	154	84	186	97	215	109	241	120	264

Allowed stresses in Kilos per sq. c.m. $\left\{ \frac{703}{1 + \frac{3L^2}{3200S^2}} \right.$
Factor of Safety 8.

L = length in metres.
S = width of side in metres.

9" □ Outside 228.6 m.m.

Area	sq. ins.	1597	2475	32	2064	250	3875	2903	45	3274	5075	3613	56
Thickness	ins.	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
Length.	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load	Safe Load
Metres	Feet	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.	Kgs.	Lbs.
3	9.842	97	213	125	276	151	334	176	388	198	437	219	482
3.5	11.483	92	203	119	263	144	318	168	370	189	417	209	460
4	13.123	87	192	113	249	137	301	159	350	179	394	197	435
4.5	14.764	82	181	106	235	129	284	150	330	169	372	186	411
5	16.404	78	171	100	221	122	268	141	311	159	351	176	387
5.5	18.044	73	161	94	208	114	252	132	292	149	330	165	364
6	19.685	68	151	88	195	107	236	124	274	140	309	154	341
6.5	21.325	64	141	83	182	100	221	116	256	131	289	145	319
7	22.966	60	132	77	170	94	206	109	240	123	279	135	298
7.5	24.606	56	124	72	160	88	194	102	225	115	254	127	280

Table No. 27.

*Safe Loads in Thousands of Kilograms and Pounds
for
Square Cast Iron Columns.*

Allowed stresses in lbs. per sq. inch
Factor of Safety 8

$$\frac{10000}{1 + \frac{3l^2}{3200s^2}}$$

s = Width of side in inches.
l = length in inches.

Allowed stresses in Kilos. per sq. c.m.
Factor of Safety 8

$$\frac{703}{1 + \frac{3l^2}{3200s^2}}$$

s = Width of side in metres.
l = length in metres.

6" □ Outside 152.4 m.m.

Area.	sq ins. sq.c.m.	71.	11.	101.6	15.75	129.	20.	153.2	23.75	174.2	27.
Thickness.	ins. m.m.	12.7	1/2"	19.1	3/4"	25.4	1"	31.7	1 1/4"	38.1	1 1/2"
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
2	6.561	43.0	94.8	61.5	135.7	78.1	172.3	92.8	204.6	105.5	232.6
2.5	8.202	39.8	87.8	57.0	125.7	72.4	159.7	86.0	189.6	97.8	215.6
3	9.842	36.7	80.9	52.5	115.8	66.7	147.0	79.2	174.6	90.0	198.5
3.5	11.483	33.4	73.7	47.9	105.6	60.8	134.0	72.2	159.2	82.1	181.0
4	13.123	30.3	66.9	43.5	95.8	55.2	121.7	65.5	144.5	74.5	164.2
4.5	14.764	27.5	60.6	39.3	86.7	49.9	110.1	59.3	130.7	67.4	148.6
5	16.404	24.8	54.7	35.6	78.4	45.2	99.5	53.6	118.2	61.0	134.4

7" □ Outside 177.7 m.m.

Area.	sq ins. sq.c.m.	121.	18.75	138.1	21.4	154.8	24.	185.5	28.75	212.9	33.
Thickness.	ins. m.m.	19.1	3/4"	22.2	7/8"	25.4	1"	31.7	1 1/4"	38.1	1 1/2"
Length.		Safe Load.		Safe Load.		Safe Load.		Safe Load.		Safe Load.	
Metres.	Feet.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.	Kgs.	lbs.
2.5	8.202	71.7	158.0	81.8	180.4	91.8	202.3	109.9	242.3	126.2	278.1
3	9.842	67.1	147.9	76.5	168.8	85.8	189.3	102.8	226.7	118.0	260.2
3.5	11.483	62.3	137.5	71.2	156.9	79.8	175.9	95.6	210.8	109.7	241.9
4	13.123	57.7	127.1	65.8	145.1	73.8	162.7	88.4	194.9	101.5	223.7
4.5	14.764	53.2	117.2	60.7	133.7	68.0	150.0	81.5	179.7	93.6	206.2
5	16.404	48.8	107.7	55.7	122.9	62.5	137.9	74.9	165.1	86.0	189.6
5.5	18.044	44.9	99.0	51.2	112.9	57.4	126.6	68.8	151.7	79.0	174.1

EXPLANATION OF TABLES OF STRENGTH OF STEEL AND IRON SECTIONS.

Tables Nos. 1, 2, 3, 4 and 5 give the loads which standard steel beams will safely carry. That is when the load is uniformly distributed over the length of the beam, the span meaning the distance between the points of support. These loads include the weight of the beam which therefore must be deducted in order to arrive at the net load which the beam will carry. If the load is concentrated at the centre of the beam take half the load as given in the tables. It is not desirable to use beams of a greater span than the span given in these tables when the under side of the beam is to be plastered, because the deflection of the beam would tend to crack the plaster. Inasmuch as the carrying capacity of beams increases largely with their depth, it is economical to use the greatest depth of beam consistent with the other conditions to which it is necessary to conform; that is equal height, etc.

Tables Nos. 6, 7, 8, 9, 10, 11, 12 and 13 give the safe loads for Phoenix columns of the sections and lengths given. It is not desirable to use columns of a greater length than that given in the table, unless the shaft of the column is supported sideways (so that it will not bend) at points not further apart than the length given in the tables. For loads which are greater than those given in the tables it is desirable to construct the column using filler bars between the segments to increase the area of the column by the amount of metal required to carry the load.

Tables Nos. 14, 15, 16 and 17 give the safe carrying capacity of Zee bar columns. The same explanation as given above for Phoenix columns holds good for this class of material.

Tables Nos. 18 to 27 inclusive, give the safe carrying capacity of cast iron columns. It is not desirable to use columns of greater length than those specified in these tables because in some cases it would be impossible to cast them.

STANDARD SPECIFICATION OF QUALITY FOR ROLLED STEEL.

All steel must be uniform in quality. The finished plates, bars and shapes must be free from injurious seams, flaws or cracks and have a clean, smooth finish.

TEST PIECES.—The tensile strength, limit of elasticity and ductibility shall be ascertained from the standard test pieces cut from finished material of at least half a square inch (3.22568 square centimetres) in section. All broken samples must show a silky fracture of uniform color and strength. The steel must have an ultimate tensile strength when tested in samples of the above dimensions of from 60,000 to 70,000 lbs. per square inch (42,184 kilos to 49,212 kilos per 10 square centimetres) and an elastic limit of not less than half the ultimate strength and the minimum elongation of 22% in 8 inches (20.319 centimetres). This steel must stand bending 180 degrees around a pin 2 inches in diameter (5.079 centimetres) without cracking of the convex surface either cold, hot or after being heated to a cherry red and cooled in water of 59 degrees Fahrenheit (15 degrees centigrade).

WEIGHTS.—A variation in cross section of weight of rolled material of more than 3% from that specified may be cause for rejection, except for such material as is less than $\frac{1}{4}$ inches thick (.6349 centimetres in thickness).

PAINTING —All steel work which is not galvanized shall be thoroughly cleaned from loose scale and rust and be given one good coat of pure boiled Linseed oil well worked into all joints and open spaces. In riveted work the surfaces coming in contact shall each be painted as above before being riveted together.

INSPECTION.—All facilities for inspection of material and workmanship shall be furnished by the contractor to competent inspectors who shall be allowed free access to any part of the works in which any portion of the material is made. The contractors shall furnish without charge such test pieces as noted above to be used to determine the character of the work furnished. If this steel does not stand the test specified it will be considered rejected and new material must be furnished in its place.

Table No. 28.

Standard spacing and dimensions of rivet and bolt holes through flanges of I beams channels and angles.




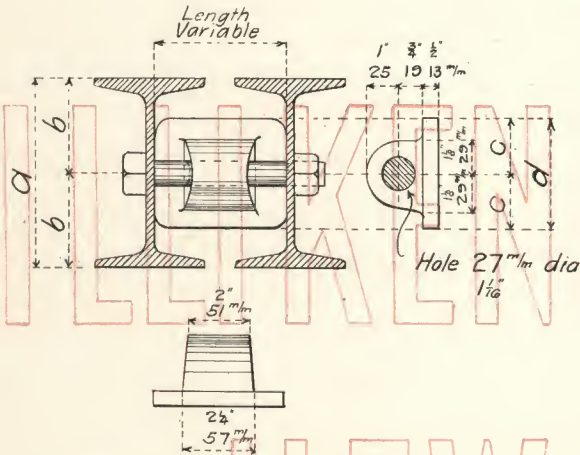
Standard I Beams						Standard Channels						Standard Angles													
Depth		Weight		a		Dia. rivet or bolt		Depth		Weight		b		Diam. rivet or bolt		Width of Leg		C		Diam. rivets or bolts					
m/m	ins	Kg. per m	lbs. ft.	m/m	ins	m/m	ins	m/m	ins	Kg. per m	lbs. ft.	m/m	ins	m/m	ins	m/m	ins	m/m	ins	m/m	ins				
609.58	24	119.05	80	101.59	4			380.99	15	66.96	45	57.14	2 1/4	19.0	3/8	177.79	7	88.89	3 1/2	25.4	1				
507.99	20	119.05	80	101.59	4			380.99	15	49.11	33	47.62	1 3/4	19.0	3/8	152.39	6	88.89	3 1/2	25.4	1				
507.99	20	96.73	65	88.89	3 1/2			304.79	12	44.64	30	50.79	2	19.0	3/8	126.99	5	69.84	2 3/4	25.4	1				
457.19	18	81.85	55	82.54	3 1/4	19.0	3/8	304.79	12	30.50	20 1/2	44.44	1 3/4	19.0	3/8	101.59	4	57.15	2 1/4	25.4	1				
380.99	15	119.05	80	95.24	3 3/4	10	3/8	253.99	10	37.20	25	50.79	2	19.0	3/8	88.89	3 1/2	50.79	2	25.4	1				
380.99	15	89.29	60	82.54	3 1/4	22.2	7/8	253.99	10	22.32	15	38.09	1 1/2	19.0	3/8	76.19	3	44.44	1 3/4	22.2	3/8				
380.99	15	62.50	42	76.19	3			228.59	9	29.76	20	44.44	1 3/4	19.0	3/8	63.49	2 1/2	34.91	1 3/8	19.0	3/8				
304.79	12	59.52	40	76.19	3			228.59	9	19.71	13 1/4	34.91	1 3/8	19.0	3/8	57.14	2 1/4	31.74	1 1/4	19.0	3/8				
304.79	12	46.87	31 1/2	69.84	2 3/4			203.19	8	24.18	16 1/2	38.09	1 1/2	19.0	3/8	50.79	2	28.56	1 1/8	15.8	5/8				
253.99	10	37.20	25	66.54	2 5/8	19.0	3/8	203.19	8	16.75	11 1/4	31.74	1 1/4	19.0	3/8	44.44	1 3/4	23.80	1 5/8	15.8	5/8				
228.59	9	31.25	21	63.49	2 1/2	19.0	3/8	177.19	7	25.67	17 1/4	38.09	1 1/2	15.8	5/8	38.09	1 1/2	20.63	1 3/8	12.7	1/2				
203.19	8	26.78	18	57.14	2 1/4	19.0	3/8	177.19	7	14.50	9 3/8	31.74	1 1/4	15.8	5/8	31.74	1 1/4	17.46	1 1/8	12.7	1/2				
177.79	7	22.32	15	57.14	2 1/4	15.8	5/8	152.39	6	19.34	13	34.91	1 3/8	15.8	5/8	25.4	1	14.28	1 1/8	9.5	3/8				
152.39	6	18.23	12 1/2	50.79	2	15.8	5/8	152.39	6	11.90	8	28.56	1 1/4	15.8	5/8										
126.99	5	14.51	9 3/8	44.44	1 3/4	12.7	1/2	126.99	5	13.39	9	31.74	1 1/4	12.7	1/2										
101.59	4	11.16	7 1/2	38.09	1 1/2	12.7	1/2	126.99	5	9.67	6 1/2	25.39	1	12.7	1/2							Width of leg	d	e	Dia. rivet or bolt
76.19	3	8.18	5 1/2	36.50	1 1/4	9.5	3/8	101.59	4	7.81	5 1/4	25.39	1	12.7	1/2							m/m	ins	m/m	ins	m/m	ins
								76.19	3	5.96	4	23.80	1 5/8	9.5	3/8	177.79	7	63.49	2 1/2	76.19	3	22.2	3/8		
																152.39	6	57.14	2 1/4	57.14	2 1/4	19.0	3/8		
																126.99	5	44.44	1 3/4	50.79	2	19.0	3/8		

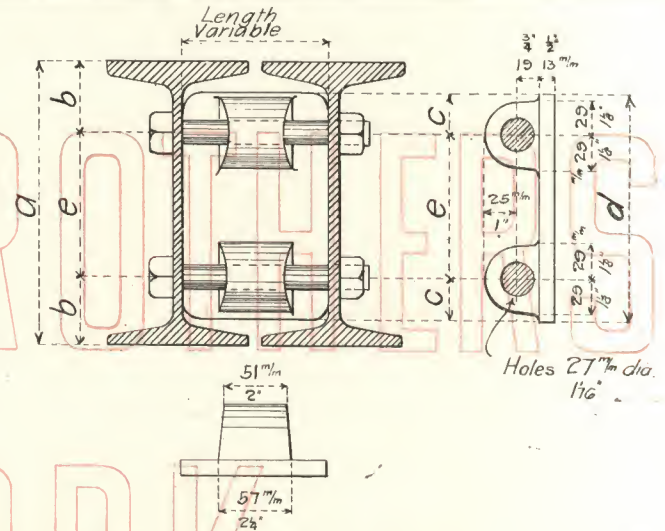
Table No. 29.

Standard Cast Separators for Beam Girders.



Mark	a		b		c		d	
	m/m	ins	m/m	ins	m/m	ins	m/m	ins
N° 5	126.99	5	63.5	2½	44.4	1½	88.9	3½
N° 6	152.39	6	76.2	3	50.8	2	101.6	4
N° 7	177.79	7	88.9	3½	63.5	2½	127.0	5
N° 8	203.19	8	101.6	4	76.2	3	152.4	6

All dimensions are given in millimetres and inches



Mark	a		b		c		d		e	
	m/m	ins	m/m	ins	m/m	ins	m/m	ins	m/m	ins
N° 9	228.59	9	57.1	2¼	29.0	1½	171.4	6¾	114.3	4½
N° 10	253.99	10	63.5	2½	29.0	1½	184.1	7½	126.9	5
N° 12	304.79	12	69.8	2¾	31.7	1¼	228.6	9	165.2	6½
N° 15	380.99	15	95.2	3¾	57.1	2¼	304.8	12	190.6	7½
N° 20	507.99	20	114.3	4½	63.5	2½	406.4	16	279.4	11
N° 24	609.58	24	114.3	4½	63.5	2½	508.0	20	381.0	15
N° 18	457.19	18	133.3	5¼	57.1	2¼	304.8	12	190.6	7½

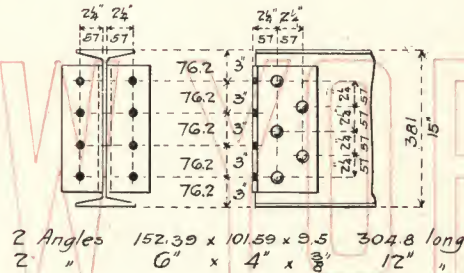
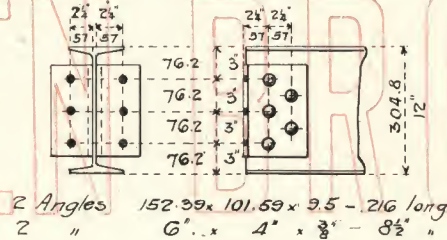
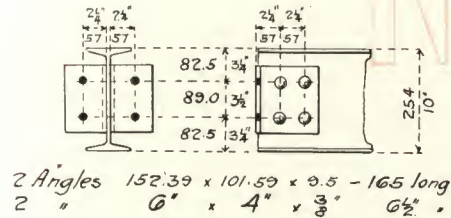
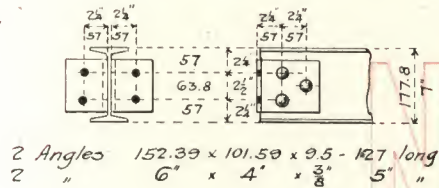
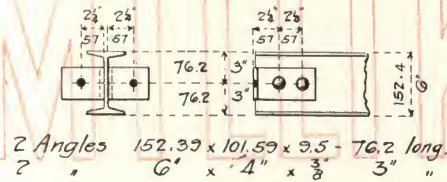
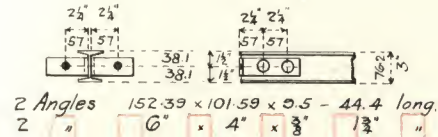
All dimensions are given in millimetres and inches.

Table No. 30.

Standard Beam Connections.

All dimensions are given in millimetres and inches.
All rivets are 19 millimetres ($\frac{3}{4}$ ") diameter.

All holes are 20.6 millimetres ($\frac{13}{16}$ ") diameter



Connections for 457.19, 507.99, 609.59 mm beams should be designed for the load that the beam is intended to carry.

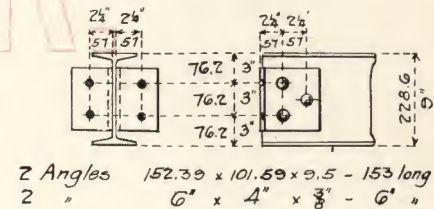
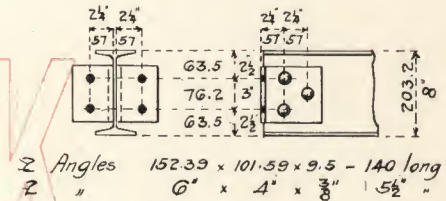
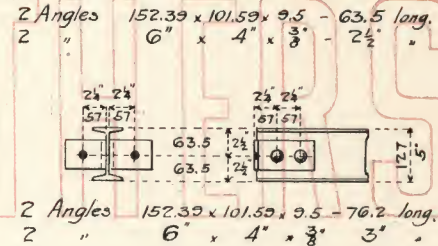
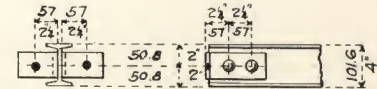


Table No. 31.

Sections of Rivetted Columns.

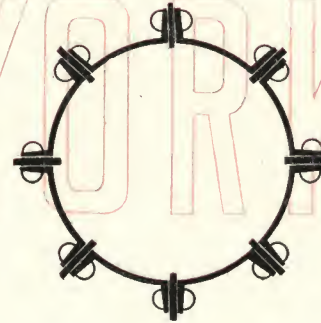
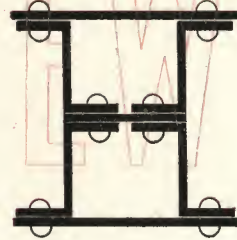
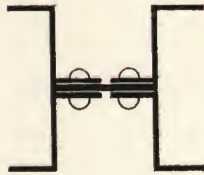
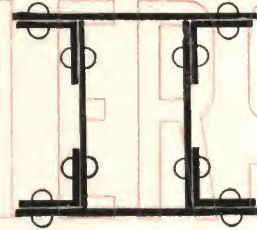
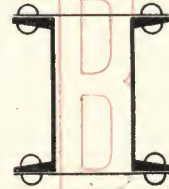


Table No. 32.

Table of meters equivalent to feet.

feet.	0	1	2	3	4	5	6	7	8	9
0		30479	6095	9143	12191	15239	18287	21335	24383	27431
10	3047945	335274	36575	39623	42671	45719	48767	51815	54863	57911
20	6095890	640068	67054	70102	73150	76198	79246	82294	85342	88390
30	9143835	944863	97534	100582	103630	106678	109726	112774	115822	118870
40	1219178	124966	128014	131062	134110	137158	140205	143253	146301	149349
50	1523972	155445	158493	161541	164589	167637	170685	173733	176781	179829
60	1828767	185925	188973	192020	195068	198116	201164	204212	207260	210308
70	2133561	216404	219452	222500	225548	228596	231644	234692	237740	240788
80	2438356	246884	249931	252979	256027	259075	262123	265171	268219	271267
90	2743150	277363	280411	283459	286507	289555	292603	295651	298699	301747

Table of feet equivalent to meters.

meters	0	1	2	3	4	5	6	7	8	9
0		32809	65618	98427	131236	164045	196854	229663	262472	295281
10	328089	360899	393708	426517	459326	492135	524944	557753	590562	623371
20	656179	688989	721798	754607	787416	820225	853034	885843	918652	951461
30	984269	101708	104989	108270	111551	114831	118112	121393	124674	127955
40	1312360	134517	137798	141079	144360	147640	150921	154202	157483	160764
50	1640450	167326	170607	173888	177169	180449	183730	187011	190292	193573
60	1968540	200135	203416	206697	209978	213258	216539	219820	223101	226382
70	2296629	232944	236225	239506	242787	246067	249348	252629	255910	259191
80	2624719	265753	269034	272315	275596	278876	282157	285438	288719	292000
90	2952809	298562	301843	305124	308405	311685	314966	318247	321528	324809

Table No. 33.

Table of Meters equivalent to each $\frac{1}{100}$ of an inch.

Inches	0	1	2	3	4	5	6	7	8	9	10	11
0.		025400	050799	076199	101598	126998	152397	177797	203196	228596	253995	279395
01	000254	025654	051053	076453	101852	127252	152651	178051	203450	228850	254249	279649
02	000508	025908	051307	076707	102106	127506	152905	178305	203704	229104	254503	279903
03	000762	026162	051561	076961	102360	127760	153159	178559	203958	229358	254757	280157
04	001015	026415	051814	077214	102613	128013	153412	178812	204211	229611	255010	280410
05	001269	026669	052068	077468	102867	128267	153666	179066	204465	229865	255264	280664
06	001523	026923	052322	077722	103121	128521	153920	179320	204719	230119	255518	280918
07	001777	027177	052576	077976	103375	128775	154174	179574	204973	230373	255772	281172
08	002031	027431	052830	078230	103629	129029	154428	179828	205227	230627	256026	281426
09	002285	027685	053084	078484	103883	129283	154683	180082	205481	230881	256280	281680
10	002539	027939	053339	078738	104137	129538	154936	180336	205735	231135	256534	281934
11	002793	028193	053592	078992	104391	129791	155190	180590	205989	231389	256788	282188
12	003047	028447	053846	079246	104645	130045	155444	180844	206243	231643	257042	282442
13	003301	028701	054100	079500	104899	130299	155698	181098	206497	231897	257296	282696
14	003555	028955	054354	079754	105153	130553	155952	181352	206751	232151	257550	282950
15	003809	029209	054608	080008	105407	130807	156206	181606	207005	232405	257804	283204
16	004063	029463	054862	080262	105661	131061	156460	181860	207259	232659	258058	283458
17	004317	029717	055116	080516	105915	131315	156714	182114	207513	232913	258312	283712
18	004571	029971	055370	080770	106169	131569	156968	182368	207767	233167	258566	283966
19	004825	030225	055624	081024	106423	131823	157222	182622	208021	233421	258820	284220
20	005079	030479	055879	081278	106677	132078	157476	182876	208275	233675	259074	284474
21	005333	030733	056132	081532	106931	132331	157730	183130	208529	233929	259328	284728
22	005587	030987	056386	081786	107185	132585	157984	183384	208783	234183	259582	284982
23	005841	031241	056640	082040	107439	132839	158238	183638	209037	234437	259836	285236
24	006095	031495	056894	082294	107693	133093	158492	183892	209291	234691	260090	285490
25	006349	031749	057148	082548	107947	133347	158746	184146	209545	234945	260344	285744
26	006603	032003	057402	082802	108201	133601	159000	184400	209799	235199	260598	285998
27	006857	032257	057656	083056	108455	133855	159254	184654	210053	235453	260852	286252
28	007111	032511	057910	083310	108709	134109	159508	184908	210307	235707	261106	286506
29	007365	032765	058164	083564	108963	134363	159762	185162	210561	235961	261360	286760
30	007619	033019	058418	083818	109217	134618	160016	185416	210815	236215	261614	287014
31	007873	033273	058672	084072	109471	134871	160270	185670	211069	236469	261868	287268
32	008127	033527	058926	084326	109725	135125	160524	185924	211323	236723	262122	287522

12 inches = 1 foot = .304794 metres

Table No. 34.

Table of Meters equivalent to each $\frac{1}{100}$ of an inch.

Inches	0	1	2	3	4	5	6	7	8	9	10	11
33	008381	033781	059180	084580	109979	135379	160778	186178	211577	236977	262376	287776
34	008635	034035	059434	084834	110233	135633	161032	186432	211831	237231	262630	288030
35	008889	034289	059688	085088	110487	135887	161286	186686	212085	237485	262884	288284
36	009143	034543	059942	085342	110741	136141	161540	186940	212339	237739	263138	288538
37	009397	034797	060196	085596	110995	136395	161794	187194	212593	237993	263392	288792
38	009651	035051	060450	085850	111249	136649	162048	187448	212847	238247	263646	289046
39	009905	035305	060704	086104	111503	136903	162302	187702	213101	238501	263900	289300
40	010159	035559	060958	086358	111757	137157	162556	187956	213355	238755	264154	289554
41	010413	035813	061212	086612	112011	137411	162810	188210	213609	239009	264408	289808
42	010667	036067	061466	086866	112265	137665	163064	188464	213863	239263	264662	290062
43	010921	036321	061720	087120	112519	137919	163318	188718	214117	239517	264916	290316
44	011175	036575	061974	087374	112773	138173	163572	188972	214371	239771	265170	290570
45	011429	036829	062228	087628	113027	138427	163826	189226	214625	240025	265424	290824
46	011683	037083	062482	087882	113281	138681	164080	189480	214879	240279	265678	291078
47	011937	037337	062736	088136	113535	138935	164334	189734	215138	240533	265932	291332
48	012191	037591	062990	088390	113789	139189	164588	189988	215387	240787	266186	291586
49	012445	037845	063244	088644	114043	139443	164842	190242	215641	241041	266440	291840
50	012699	038099	063498	088898	114297	139697	165096	190496	215895	241295	266694	292094
51	012953	038353	063752	089152	114551	139951	165350	190750	216149	241549	266948	292348
52	013207	038607	064006	089406	114805	140205	165604	191004	216403	241803	267202	292602
53	013461	038861	064260	089660	115059	140459	165858	191258	216657	242057	267456	292856
54	013715	039115	064514	089914	115313	140713	166112	191512	216911	242311	267710	293110
55	013969	039369	064768	090168	115567	140967	166366	191766	217165	242565	267964	293364
56	014223	039623	065022	090422	115821	141221	166620	192020	217419	242819	268218	293618
57	014477	039877	065276	090676	116075	141475	166874	192274	217673	243073	268472	293872
58	014731	040131	065530	090930	116329	141729	167128	192528	217927	243327	268726	294126
59	014985	040385	065784	091184	116583	141983	167382	192782	218181	243581	268980	294380
60	015239	040639	066038	091438	116837	142237	167636	193036	218435	243835	269234	294634
61	015493	040893	066292	091692	117091	142491	167890	193290	218689	244089	269488	294888
62	015747	041147	066546	091946	117345	142745	168144	193544	218943	244343	269742	295142
63	016001	041401	066800	092200	117599	142999	168398	193798	219197	244597	269996	295396
64	016255	041655	067054	092254	117853	143253	168652	194052	219451	244851	270250	295650
65	016509	041909	067308	092708	118107	143507	168906	194306	219705	245105	270504	295904

12 inches = 1 foot = 304794 metres.

Table No. 35.

Table of Meters equivalent to each $\frac{1}{100}$ of an inch.

Inches	0	1	2	3	4	5	6	7	8	9	10	11
66	016763	042163	067562	092962	118361	143761	169160	194560	219959	245359	270758	296158
67	017017	042417	067816	093216	118615	144015	169414	194814	220213	245613	271012	296412
68	017271	042671	068070	093470	118869	144269	169668	195068	220467	245867	271266	296666
69	017525	042925	068324	093724	119123	144523	169922	195322	220721	246121	271520	296920
70	017779	043179	068578	093978	119377	144777	170176	195576	220975	246375	271774	297174
71	018033	043433	068832	094232	119631	145031	170430	195830	221229	246629	272028	297428
72	018287	043687	069086	094486	119885	145285	170684	196084	221483	246883	272282	297682
73	018541	043941	069340	094740	120139	145539	170938	196338	221737	247137	272536	297936
74	018795	044195	069594	094994	120393	145793	171192	196592	221991	247391	272790	298190
75	019049	044449	069848	095248	120647	146047	171446	196846	222245	247645	273044	298444
76	019303	044703	070102	095502	120901	146301	171700	197100	222499	247899	273298	298698
77	019557	044957	070356	095756	121155	146555	171954	197354	222753	248153	273552	298952
78	019811	045211	070610	096010	121409	146809	172208	197608	223007	248407	273806	299206
79	020065	045465	070864	096264	121663	147063	172462	197862	223261	248661	274060	299460
80	020319	045719	071118	096518	121917	147317	172716	198116	223515	248915	274314	299714
81	020573	045973	071372	096772	122171	147571	172970	198370	223769	249169	274568	299968
82	020827	046227	071626	097026	122425	147825	173224	198624	224023	249423	274822	300222
83	021081	046481	071880	097280	122679	148079	173478	198878	224277	249677	275076	300476
84	021335	046735	072134	097534	122933	148333	173732	199132	224531	249931	275330	300730
85	021589	046989	072388	097788	123187	148587	173986	199386	224785	250185	275584	300984
86	021843	047243	072642	098042	123441	148841	174240	199640	225039	250439	275838	301238
87	022097	047497	072896	098296	123695	149095	174494	199894	225293	250693	276092	301492
88	022351	047751	073150	098550	123949	149349	174748	200148	225547	250947	276346	301746
89	022605	048005	073404	098804	124203	149603	175002	200402	225801	251201	276600	302000
90	022859	048259	073658	099058	124457	149857	175256	200656	226055	251455	276854	302254
91	023113	048513	073912	099312	124711	150111	175510	200910	226309	251709	277108	302508
92	023367	048767	074166	099566	124965	150365	175764	201164	226563	251963	277362	302762
93	023621	049021	074420	099820	125219	150619	176018	201418	226817	252217	277616	303016
94	023875	049275	074674	100074	125473	150873	176272	201672	227071	252471	277870	303270
95	024129	049529	074928	100328	125727	151127	176526	201926	227325	252725	278124	303524
96	024383	049783	075182	100582	125981	151381	176780	202180	227579	252979	278378	303778
97	024637	050037	075436	100836	126235	151635	177034	202434	227833	253233	278632	304032
98	024891	050291	075690	101090	126489	151889	177288	202688	228087	253487	278886	304286
99	025145	050545	075944	101344	126743	152143	177542	202942	228341	253741	279140	304540

12 inches = 1 foot = 304794 metres.

Table No. 36.

Table of Kilograms equivalent to each $\frac{1}{16}$ of Pounds Avoirdupois.

Pounds Avoirdupois	0	1	2	3	4	5	6	7	8	9
0		453593	907185	136078	181437	226796	272156	317515	362874	408233
1	045359	498952	952544	140613	185973	231331	276691	322051	367410	412769
2	090718	544311	997903	145149	190509	235867	281227	326587	371946	417305
3	136078	589671	1043263	149685	195045	240403	285763	331122	376482	421841
4	181437	635030	1088622	154221	199581	244939	290299	335658	381018	426377
5	226796	680389	1133981	158757	204117	249475	294835	340194	385554	430913
6	272156	725749	1179341	163293	208653	254011	299371	344730	390090	435449
7	317515	771108	1224700	167829	213189	258547	303907	349266	394626	439985
8	362874	816467	1270059	172365	217725	263083	308443	353802	399162	444521
9	408233	861826	1315418	176901	222260	267619	312978	358338	403697	449057

Table of Kilograms equivalent to Pounds Avoirdupois.

Pounds Avoirdupois	0	1	2	3	4	5	6	7	8	9
0		453593	90718	136078	181437	226796	272156	317515	362875	408233
10	4535927	498952	544312	589671	635030	680390	725749	771108	816467	861827
20	9071853	952545	997904	104326	108862	113398	117934	122470	127006	131542
30	1360780	140614	145150	149686	154222	158757	163293	167829	172365	176901
40	1814371	185973	190509	195045	199581	204117	208653	213189	217725	222260
50	2267963	231332	235868	240404	244940	249476	254012	258548	263084	267620
60	2721556	276691	281227	285763	290299	294835	299371	303907	308443	312978
70	3175149	322051	326587	331122	335658	340194	344730	349266	353802	358338
80	3628741	367410	371946	376482	381018	385554	390090	394626	399162	403697
90	4082334	412769	417305	421841	426377	430913	435449	439985	444521	449057

Table No. 37.

Table of Kilograms per meter equivalent to Pounds per foot.

Pounds per Foot.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0		14882	29764	44646	59528	74410	89292	10417	11905	13393	14882	16370	17858	19346	20834	22323	23811	25299	26787	28275
1	14882	16370	31252	46134	61016	75898	90780	10565	12053	13541	15030	16518	18006	19494	20982	22471	23959	25447	26935	28423
2	29764	17858	32740	47622	62504	77386	92268	10714	12202	13690	15179	16667	18155	19643	21131	22620	24108	25596	27084	28572
3	44646	19346	34228	49110	63992	78874	93756	10863	12351	13839	15328	16816	18304	19792	21280	22769	24257	25745	27233	28721
4	59528	20834	35716	50598	65480	80362	95244	11012	12500	13988	15477	16965	18453	19941	21429	22918	24406	25894	27382	28870
5	74410	22323	37205	52087	66969	81851	96733	11161	12649	14138	15626	17114	18602	20090	21578	23067	24555	26043	27531	29019
6	89292	23811	38693	53575	68457	83339	98221	11310	12797	14285	15774	17262	18750	20238	21726	23215	24703	26191	27679	29167
7	104174	25299	40181	55063	69945	84827	99709	11458	12946	14434	15923	17411	18899	20387	21875	23364	24852	26340	27828	29316
8	119056	26787	41669	56551	71433	86315	101197	11607	13095	14583	16072	17560	19048	20536	22024	23513	25001	26489	27977	29465
9	133938	28275	43157	58039	72921	87803	102685	11756	13244	14732	16221	17709	19197	20685	22173	23662	25150	26638	28126	29614
Pounds per Foot.	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
0	29764	31252	32740	34228	35716	37205	38693	40181	41669	43157	44646	46134	47622	49110	50598	52087	53575	55063	56551	58039
1	29912	31400	32888	34376	35864	37353	38841	40329	41817	43305	44794	46282	47770	49258	50746	52235	53723	55211	56699	58187
2	30061	31549	33037	34525	36013	37502	38990	40478	41966	43454	44943	46431	47919	49407	50895	52384	53872	55360	56848	58336
3	30210	31698	33186	34674	36162	37651	39139	40627	42115	43603	45092	46580	48068	49556	51044	52533	54021	55509	56997	58485
4	30359	31847	33335	34823	36311	37800	39288	40776	42264	43752	45241	46729	48217	49705	51193	52682	54170	55658	57146	58634
5	30508	31996	33484	34972	36460	37949	39437	40925	42413	43901	45390	46878	48366	49854	51342	52831	54319	55807	57295	58783
6	30656	32144	33632	35120	36608	38097	39585	41073	42561	44049	45538	47026	48514	50002	51490	52979	54467	55955	57443	58931
7	30805	32293	33781	35269	36757	38246	39734	41222	42710	44198	45687	47175	48663	50151	51639	53128	54616	56104	57592	59080
8	30954	32442	33930	35418	36906	38395	39883	41371	42859	44347	45836	47324	48812	50300	51788	53277	54765	56253	57741	59229
9	31103	32591	34079	35567	37056	38544	40032	41520	43008	44496	45985	47473	48961	50449	51937	53426	54914	56402	57890	59378
Pounds per Foot.	40	42	43	44	45	46	47	48	49	50	55	60	65	70	75	80	85	90	95	100
0	59528	62504	63992	65480	66969	68457	69945	71433	72921	74410	81851	89292	96733	104174	111615	119056	126497	133938	141379	148820
25	59900	62876	64364	65852	67341	68829	70317	71805	73293	74782	82223	89664	97105	104546	111987	119428	126869	134310	141751	149192
50	60272	63248	64736	66224	67713	69201	70689	72177	73665	75154	82595	90036	97477	104918	112359	119800	127241	134682	142123	149564
75	60644	63620	65108	66596	68085	69573	71061	72549	74037	75526	82967	90408	97849	105290	112731	120172	127613	135054	142495	149936

EXPLANATION OF TABLES

GIVING STANDARDS FOR PUNCHING, STANDARD CAST SEPARATORS, STANDARD BEAM BRACKETS AND EQUIVALENTS OF ENGLISH AND METRIC SYSTEMS.

Table No. 28 gives the standard dimension for punching the flanges of beams, channels and angles, and will be very useful in laying out and designing work.

Table No. 29 gives the dimensions and details of cast iron separators as used between beams when they are placed together to form girders.

Table No. 30 gives the standard dimension for brackets at the ends of beams where they connect one with the other.

Table No. 31 shows the different forms of columns which may be constructed by riveting together different classes of rolled steel. An infinite number could be made by making different combinations but those shown are the ones most commonly used.

Tables 32 to 37 inclusive will be found very useful for transferring weights and measures from the Metric to the English system or vice-versa.

Plate No. 32.

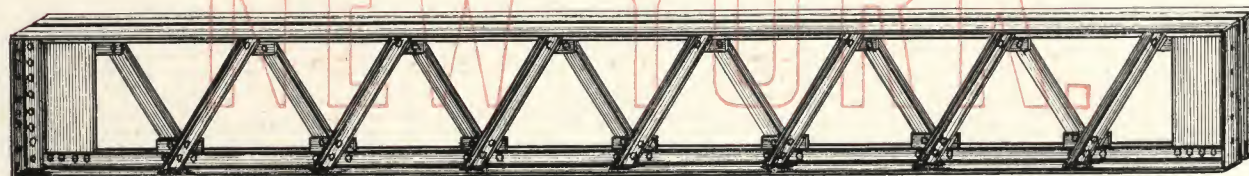


Plate No. 33.

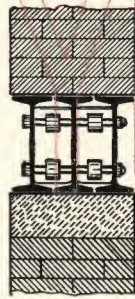
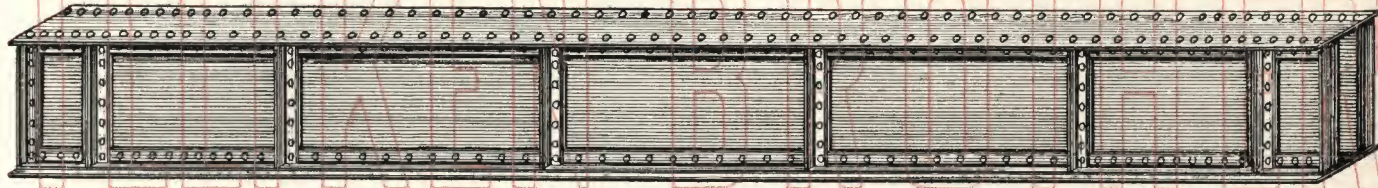


Plate No. 34.

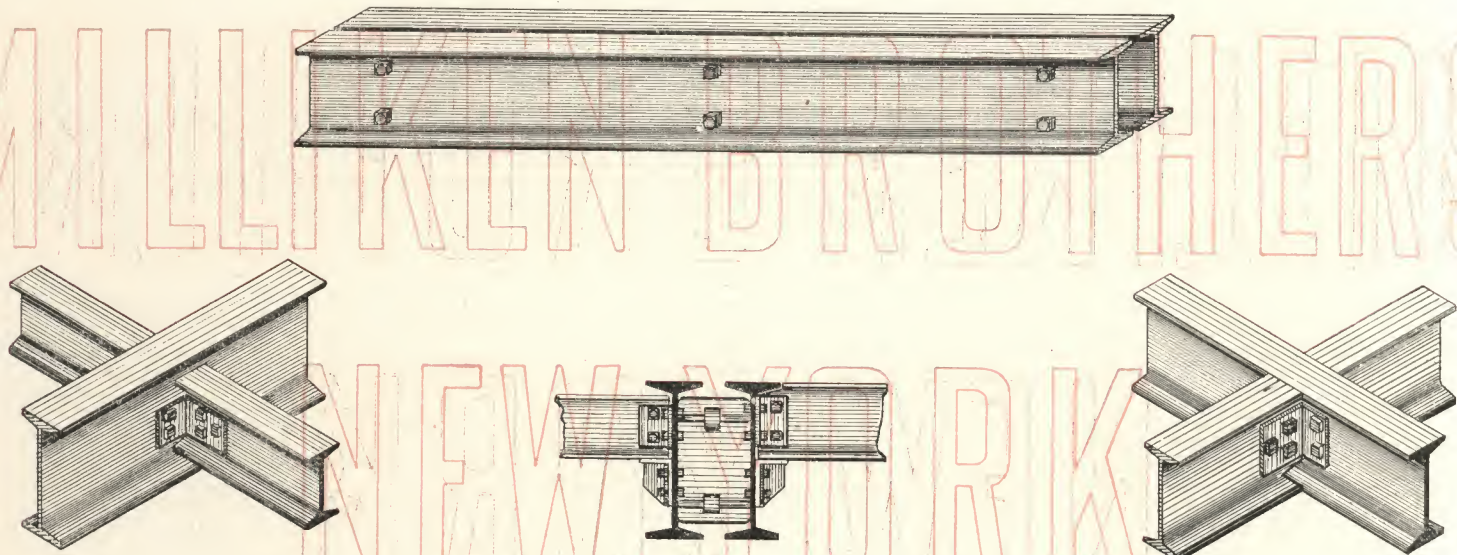


Plate No. 35.

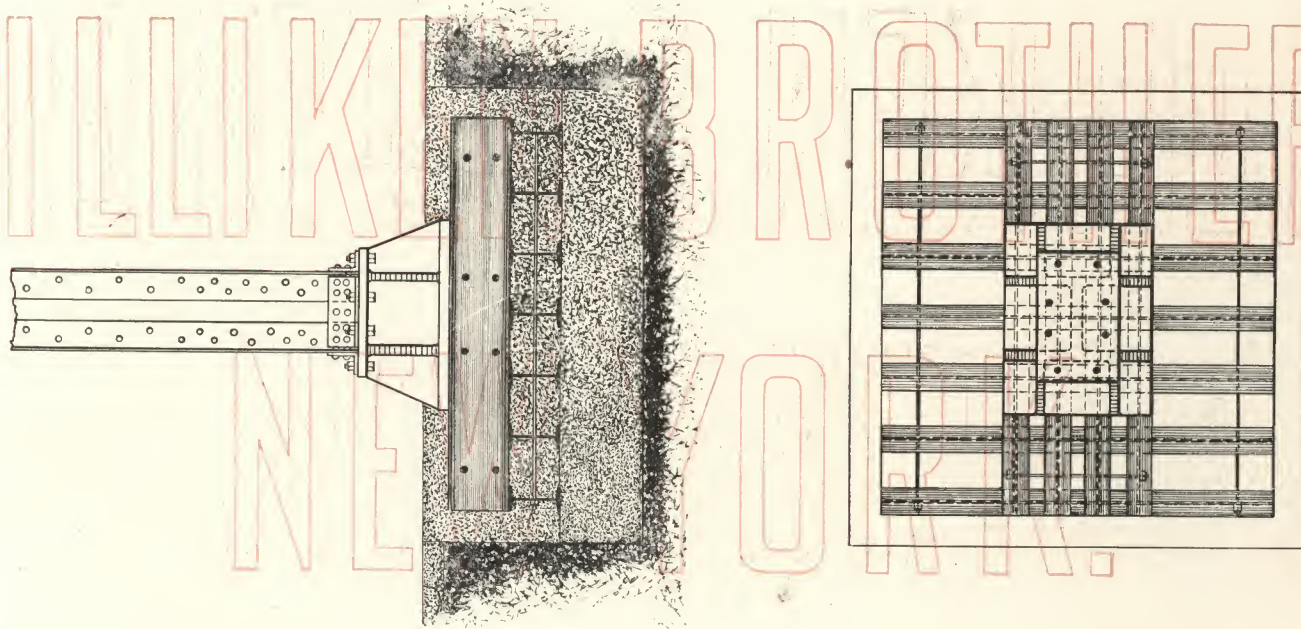


Plate No. 36.

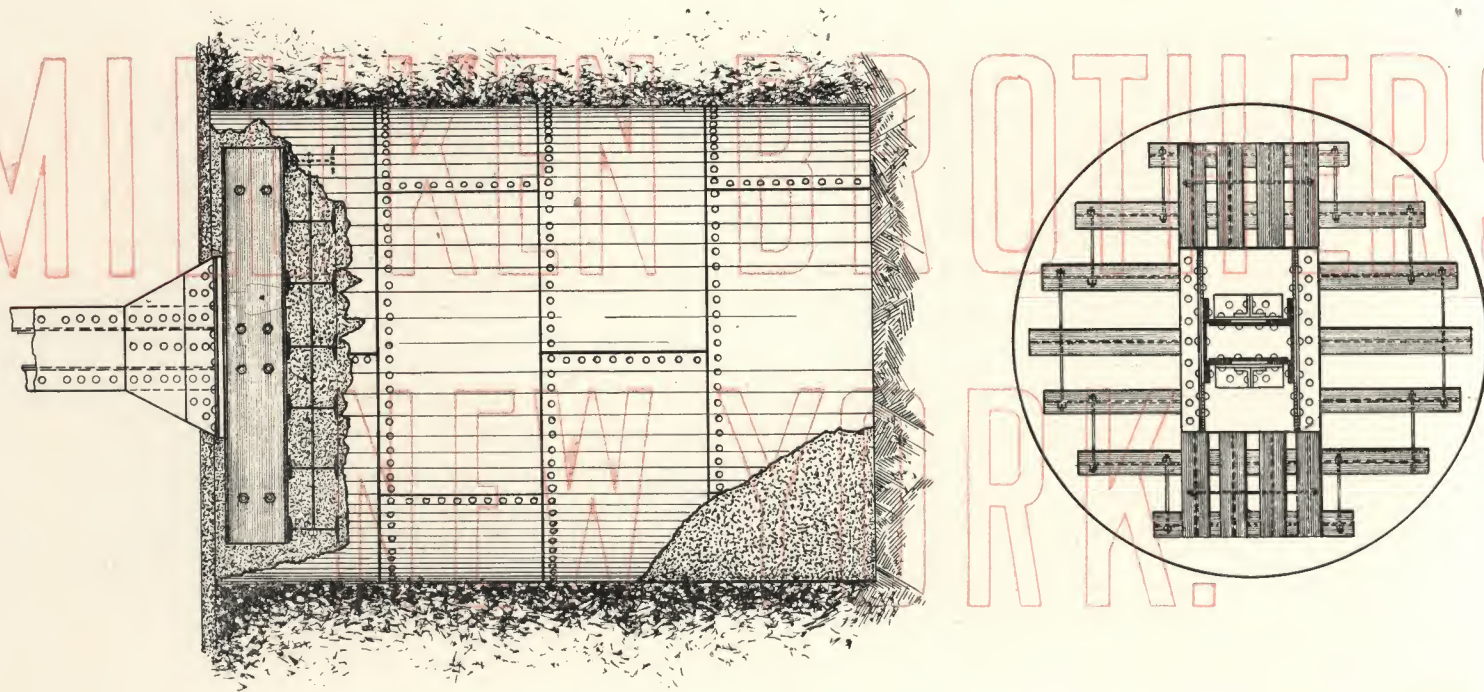
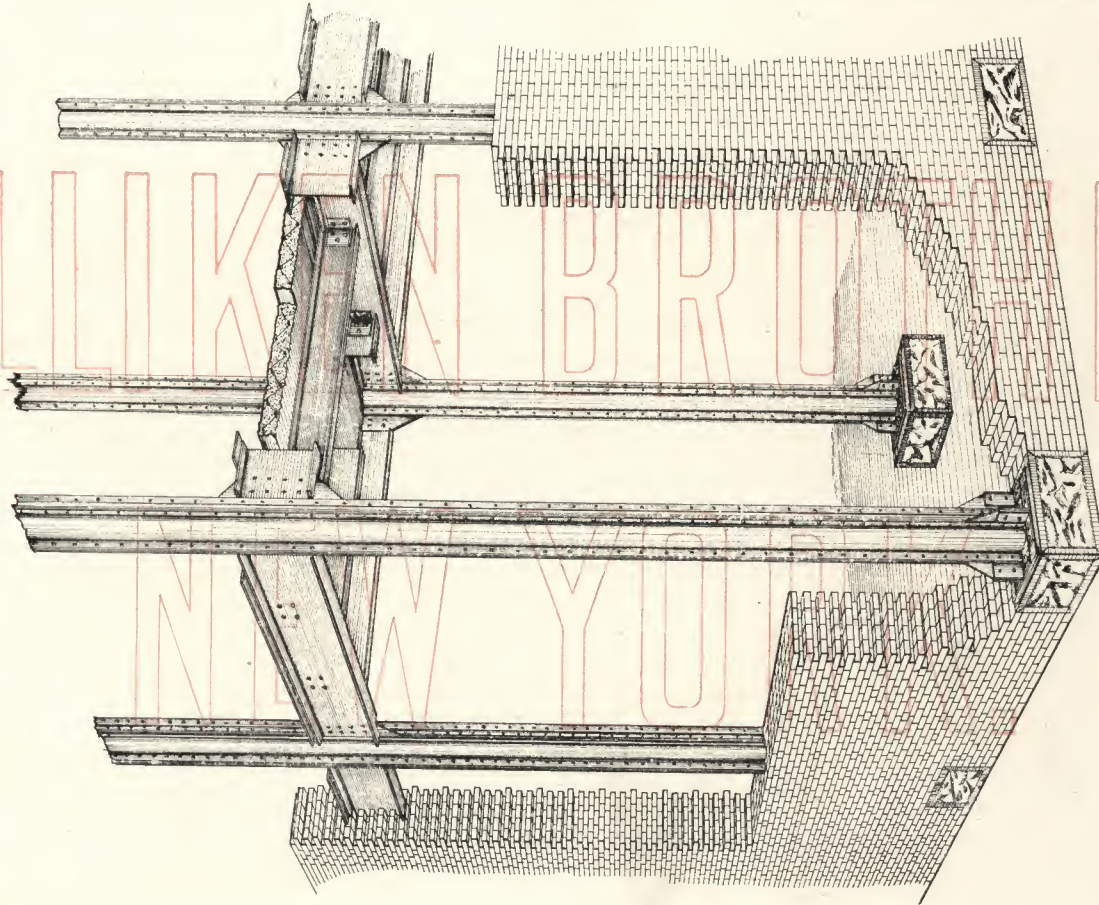


Plate No. 37.



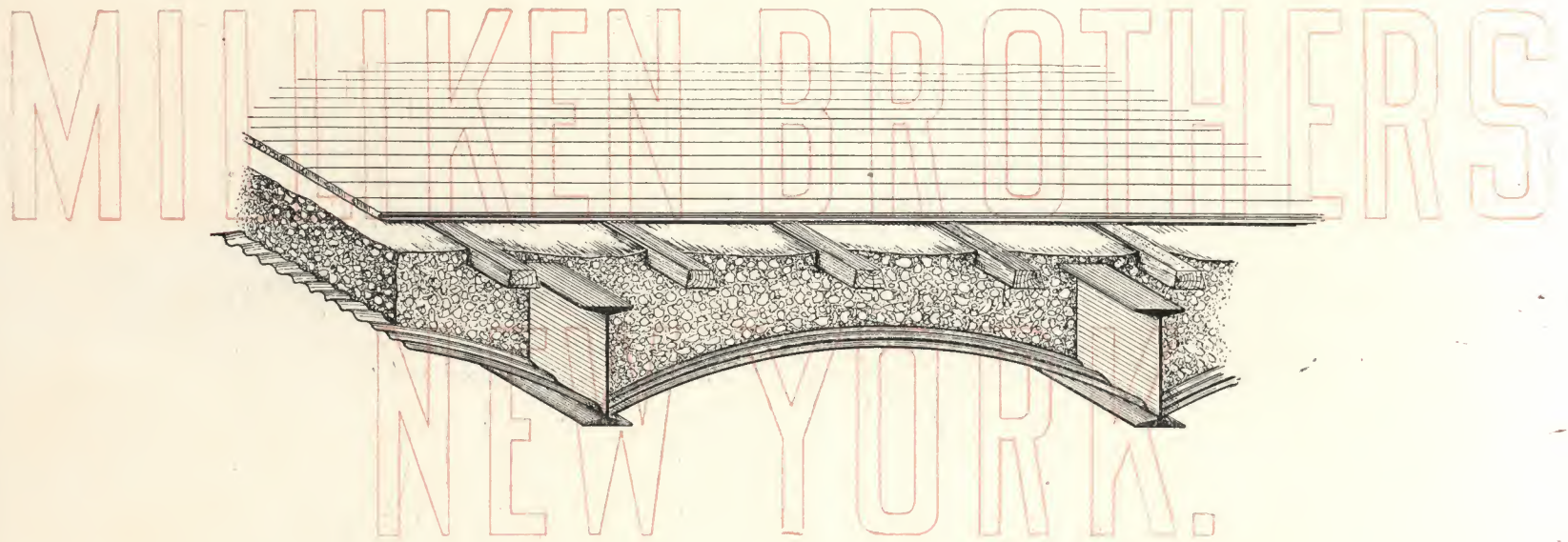


Plate No. 39.

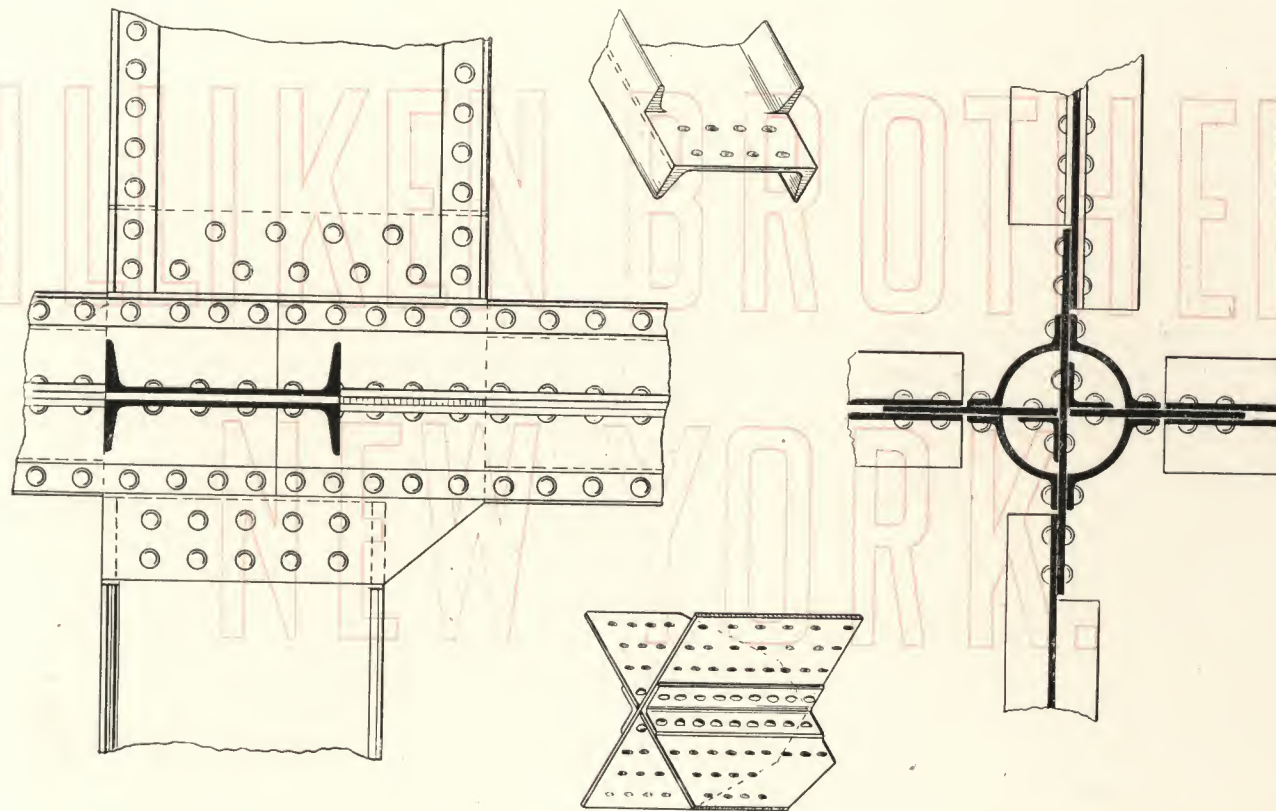


Plate No. 40.

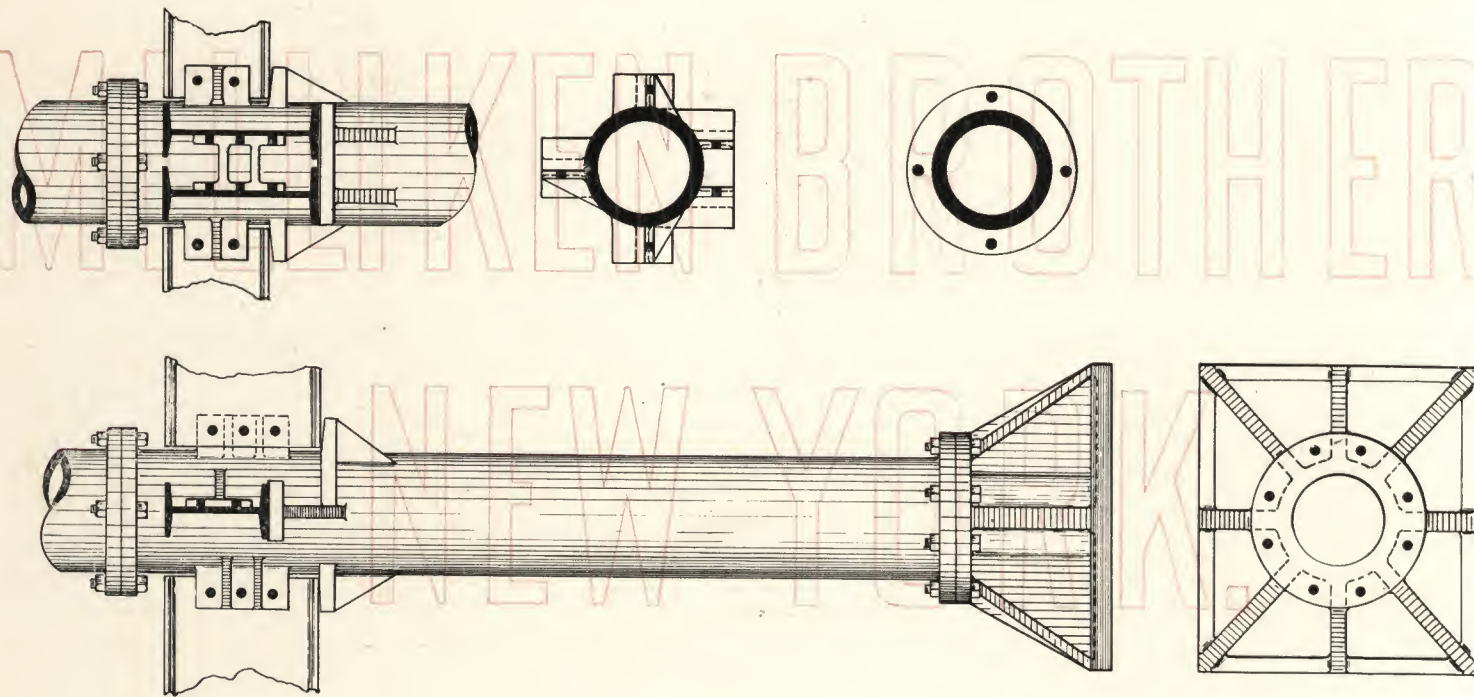
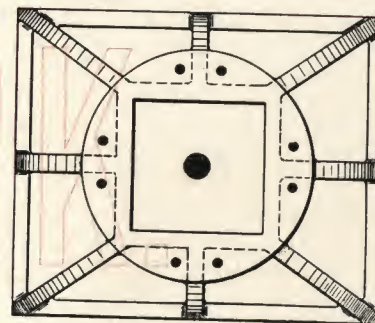
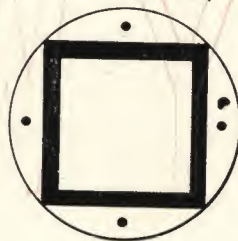
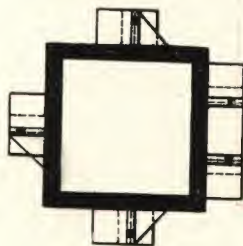
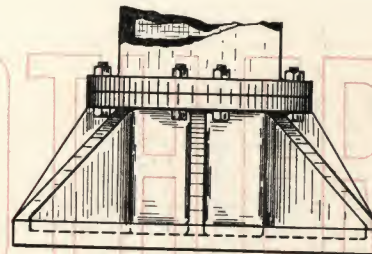
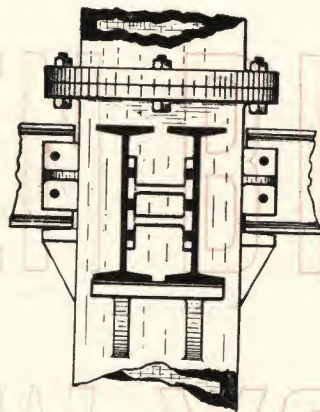
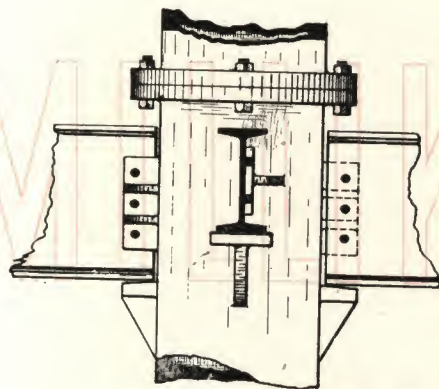


Plate No. 41.



FIRE-PROOF FLOORS FOR BUILDINGS.

Owing to the large quantity of perishable goods stored in buildings, and to the number of lives often at stake, it is becoming a custom to construct important buildings in a fireproof manner. Due to the cheapness in which steel can be made to use in these buildings the use of it is becoming more and more general, resulting in practically indestructible buildings, and with careful attention to painting in cases where the steel work is exposed they will last for an indefinite number of years. The question of the insurance alone, on goods stored in these buildings will often pay the small difference in the cost between iron and wood construction, not to speak of the question of the destruction of a wooden building in the course of a few years owing to decay and rot.

From our experience in supplying steel buildings for countries subject to earthquakes, we find that these buildings stand a great deal better than any other form of building made.

Generally the construction of a fireproof floor is made by supporting the floor on columns which can be either cast iron or rolled steel of various sections as shown on Table No. 31. These columns rest on a foundation composed of brick or concrete, and it is usual to cap the same with a very large stone dressed straight and smooth on which the shoe of the column rests. This stone should be considerably larger than the base of the column, the exact size depending on the load to be transmitted.

The kind of material which should be used in the construction of the part immediately below the stone,

also the thickness of the stone itself, can only be determined by calculation and depends largely on the load to be carried and the nature of the soil. In cases of extra heavy loads and where the earth is not very hard it is customary to use a grillage composed of steel beams set close together and carefully encased in concrete. This is clearly shown on plate No. 35. The shoe of the column then rests on top of these beams, the idea being to distribute the load brought by the column over a sufficiently large surface of the soil. Sometimes it becomes necessary, owing to the nature of the soil, to sink caissons, which are usually made of heavy plate, circular in shape or, sometimes, square. The circular caissons of this form of construction are shown on Plate No. 36. The earth or soil should all be removed from these cylinders or tanks and the entire inside of same filled in with concrete and on this concrete the grillage beams rest.

The question of the kind of column to use is determined more or less by the load the column has to carry and what the building is intended to be used for. Cast iron columns are often employed and the outside of these can be ornamented to any extent desired, as fully explained in the latter part of this Catalogue. The shaft of the column can be either plain, as shown on Plate No. 40, in which case the shaft of the column is left exposed to view in the building, or in another case it is surrounded by some form of fireproofing such as terra-cotta, cement, or some of the patent plasters, which are often finished in the imitation of marble. Of course, cast iron columns can be furnished either round or square, see Plate No. 41, showing the details of the square cast-iron columns. We do not advocate using cast iron columns for several reasons. First, because it is almost impossible to manufacture a perfect column in this metal, as cast-iron is more or less liable to have flaws or imperfections which it is impossible to detect. Our second reason is because in shipping this class of goods out of the country the castings are very apt to be handled during transit in a rough manner and get broken, and if the break happens to be a bad one it is impossible to fix it and the column has to be duplicated, thereby losing in many cases valuable time. We therefore strongly recommend the use of rolled steel columns which are not open to the objections as named above. Owing to the difference in weight

it will be found that the price of steel columns is about the same as that of cast iron ones. Of the different kinds of rolled steel columns that are generally used we recommend columns formed of either angles and plates; channels and plates; the Zee bar columns, or Phoenix columns. All of these columns lend themselves to building construction. The details of the columns are fully explained in preceding plates. If the Phoenix columns are used we would recommend what is known as the "cross pintle connection" shown on Plate No. 39.

The floors of the building are constructed by spanning the beams from column to column or, if one single beam will not carry the load, then use two beams or a riveted girder of either the single web or box construction. Sketch of the single web girder is shown on the upper part of Plate No. 32, and the open work or lattice girder is shown on the lower part of the same plate.

The sketch of the box girder is shown on the upper part of Plate No. 33.

If two beams are used to make a girder it is necessary to connect them by means of cast iron separators, these are detailed in Table No. 29. The use of these separators is shown on the central and lower part of Plate No. 33 and on Plate No. 34.

There are several different methods of securing floor beams to the girders. Sometimes the floor beams rest on top of the girders and are simply secured to the girders by means of bolts through the flanges. We do not consider this good construction as it does not stiffen the floor, and it also takes off from the height of the room below the distance the girder projects below the floor beams. It is usual to attach the floor beams to the web of the girder or to other beams by means of brackets, as shown in detail Table No. 30. Two brackets are required for each beam connection. These brackets are shown in a sketch on Plate No. 34. These brackets are usually riveted to the beams and bolted to the girders. When the top of the floor beams and top of the girder are level it is necessary to cut out the flange of the floor beam. This is called

coping, sketch of which is shown on Plate No. 34, the lower right hand sketch. When the beam is dropped below the flange of the girder or other beam the coping is not necessary. The same is shown on Plate No. 34, the lower left hand sketch. It is always advisable in designing a floor to have one of the floor beams come opposite to the columns so as to stiffen the column connection at the floor.

In case of a low building in which the loads are not very great it is advisable to build the walls of the building of brick or stone to allow the floor beams to rest on the wall, but, where the building is of considerable height and the floor loads great it is always advisable to have a line of beams or girders just inside the wall to support the ends of the floor beams on such beam or girder and thus make the walls of the building independent of the floor construction. In other cases where the building is very high, it is desirable to not only support the floors independent of the walls but in addition to carry the walls themselves on the steel work, which is known as full skeleton construction. The walls in this case are supported on each floor level by the iron work and the walls are simply a shell to keep the weather out and the mason work does not therefore carry any loads. See Plate No. 37, which shows a portion of a building illustrating general matters regarding the above. It will be noticed from this plate that the mason work projects outside of the girders at the floor level; this usually amounts to about 4 inches and is necessary in order to thoroughly fireproof the girders, protecting them from fire in an adjoining building.

The floor itself to be fireproof is usually made of some indestructible material. One of the forms usually adopted in foreign countries is shown on Plate No. 38, and consists of curved corrugated galvanized steel arches set in between the beams, on top of which concrete is placed, and in this concrete sleepers carrying a wooden floor are laid. This form of construction has some disadvantages, although cheapness is in its favor; the one principal objection to it is that the underside of the beams in the floor is left exposed and in case of fire the beams are very apt to get heated and will then bend and the floor will

fall. This construction also requires to be carefully painted, otherwise it will rust and will sooner or later eat through the sheet iron.

In this form of construction the floor beams should be placed from three to five feet apart or say, (1 to 1.5 metres.) There is a number of different forms of floor construction used in this country, probably the most common of which are the hollow fireproof bricks and tiles of terra cotta and hard burned clay; there are several kinds of these, and in addition to this there is a number of full concrete construction floors.

We would also call your attention to a form of construction which we are using considerably, known as the "Milliken Patent Floor," and which is fully explained later on in this catalogue.

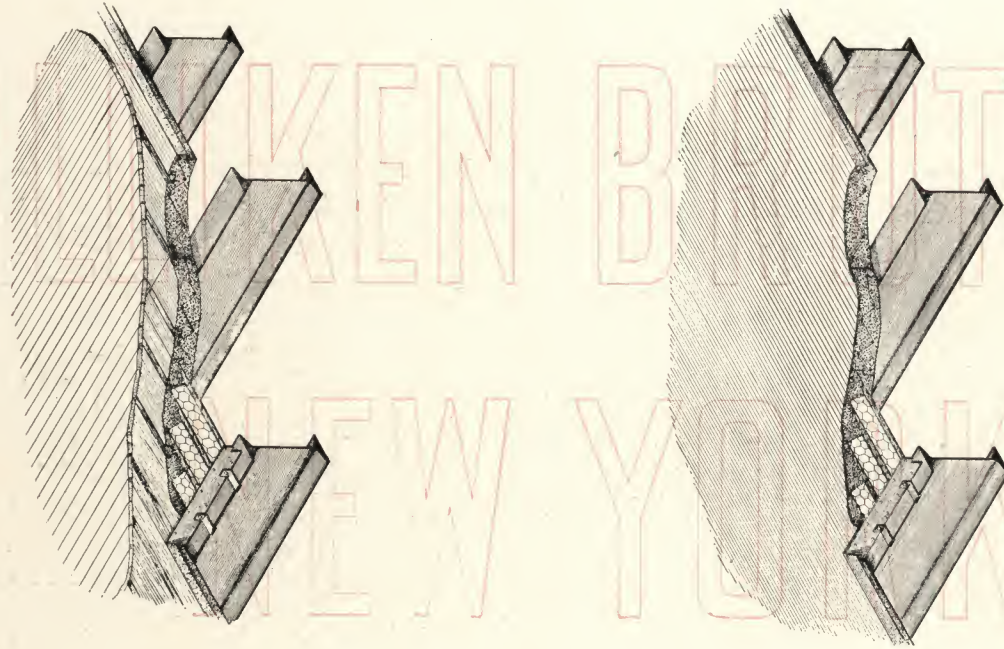
The following are the loads which we recommend for the different classes of buildings, that is the loads which the floors should be figured to sustain, not including the weight of the construction of the floor itself or the weight of the beams, both of which must be added in making calculation of the sizes required for the floor beams and girders.

70 lbs. per square foot for floors of dwelling houses and offices, equal to 341.7825 kilos per square metre.

125 lbs. per square foot for floors of Churches, Theatres and Ballrooms, equal to 613.3257 kilos per square metre.

200 to 250 lbs. per square foot for floors of Warehouses, equal to 976.5215 to 1220.6519 kilos per square metre.

250 to 400 lbs. per square foot for floors for heavy machinery, equal to 1220.6519 to 1953.043 kilos per square metre.



ANGLO-SWISS CONDENSED MILK CO.'S BUILDING, BROOKLYN, N. Y.



MILLIKEN PATENT ROOF CONSTRUCTION, SHOWING WIRE WORK AND WOODEN CENTERS BEFORE CONCRETE WAS IN PLACE.

ANGLO-SWISS CONDENSED MILK CO.'S BUILDING, BROOKLYN, N. Y.



MILLIKEN PATENT ROOF CONSTRUCTION AFTER CONCRETE IS IN PLACE.

MILLIKEN PATENT CONCRETE SLAB FLOORING AND PARTITION.

Owing to the large demand for a floor that would withstand fire and at the same time be light and durable, we have succeeded in constructing a slab composed of steel rods and woven wire, which are embedded in concrete, composed of cement, sand and broken stone or cinder. This slab, as used for floor construction, is clearly shown on Plate No. 42. The cut to the left shows the floor with wooden sleepers embedded in the concrete, to which are nailed the wood flooring boards which are used as a wearing surface. The cut to the right represents the floor without the sleepers and simply finished with a cement surface. This same class of floor is shown in Plate No. 37.

In certain locations where it is easy to get cement, sand and broken stone, we make a practice of shipping the woven wire and steel rods and arranging for the concrete to be supplied at the building. In other cases we ship the slabs manufactured, that is all concreted.

This form of construction lends itself particularly well to partitions for buildings. Figure No. 1, is a photograph of a small sample partition, at one corner of which the concrete has been left out to show the arrangement of the wires and rods. These partitions run from ceiling to floor and form a perfect resistance to fire as it is absolutely impossible to detach

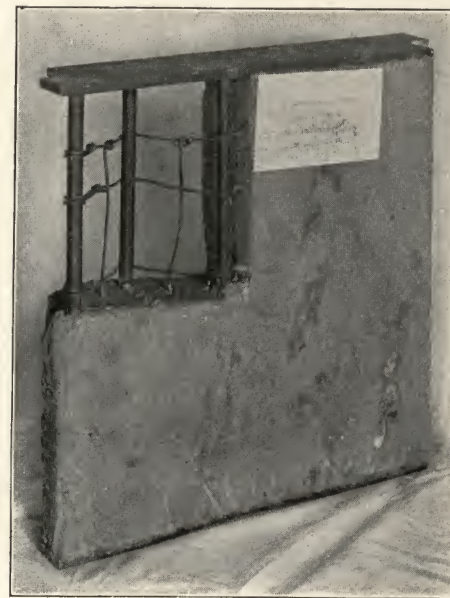


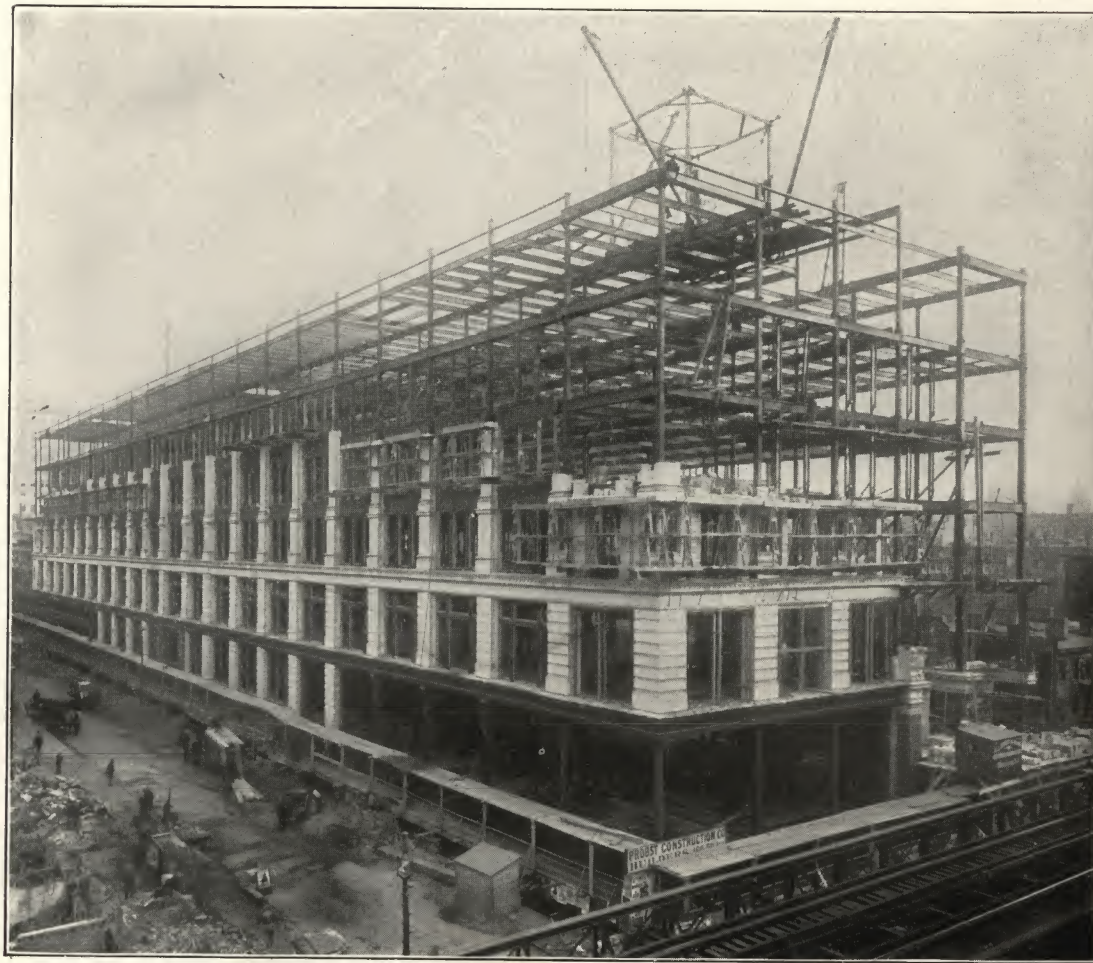
FIGURE 1.

the concrete from the wire. The finish of the slabs can be made perfectly smooth, in which case it is advisable to paint the outside surface of the slabs after they are erected in place. When this is done and it is desirable to clean the partition, it is simply necessary to turn a stream of water on the same.

This form of construction lends itself particularly to the covering of roofs where it is desirable to make the building absolutely waterproof. The same form of construction as that used for partition work is laid on the roof purlins, and it is only necessary to give the upper surface of the roof a coat of tar and gravel to make it water-tight. Any damage can easily be repaired by the addition of a small quantity of cement and the coating referred to above. The roof of quite a large building is shown in a photograph on pages 107 and 108. On page 107, the wire work is shown before the concrete was placed on the roof and while the wood centres underneath were still in position.

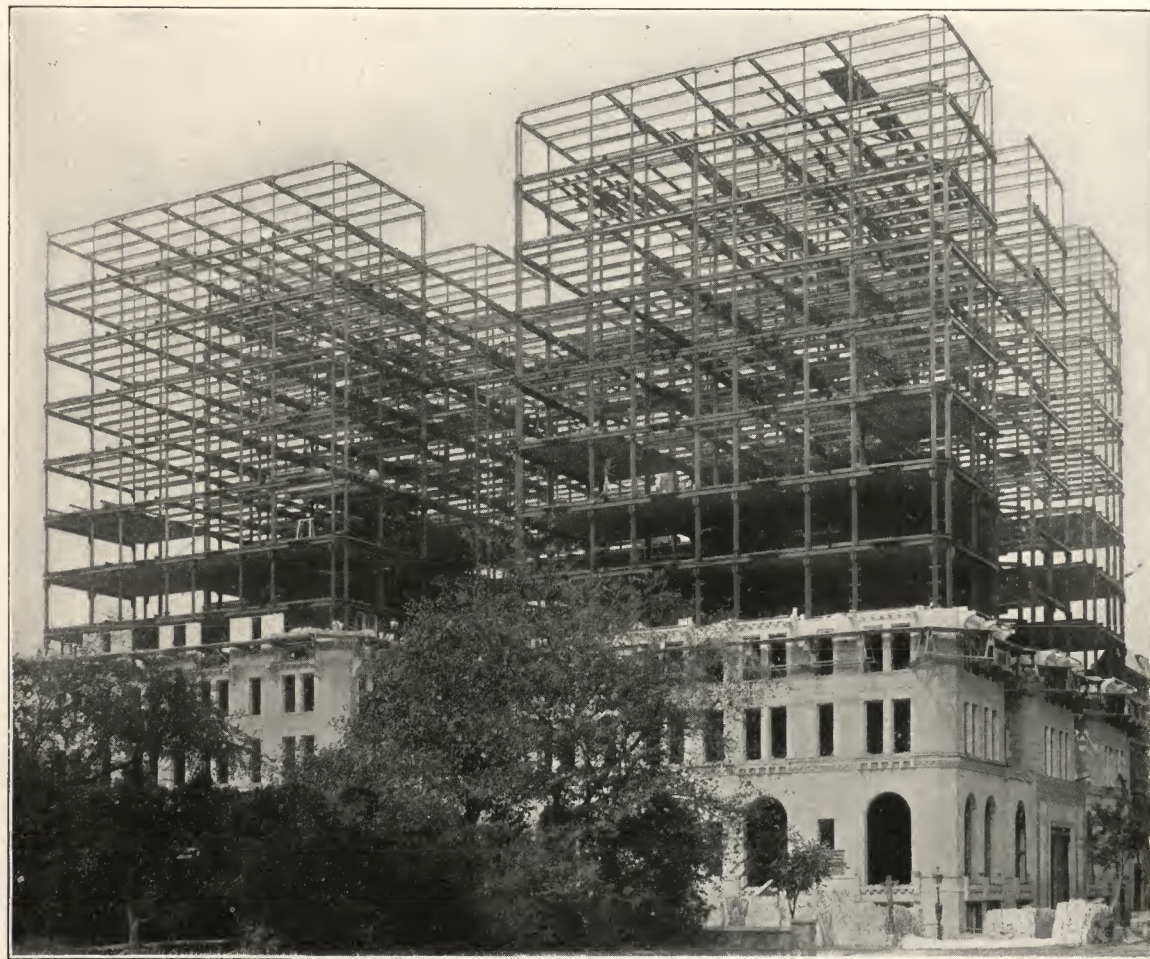
The photograph on page 108 shows a portion of the same roof after it was concreted, and although it is not shown in the photograph the concrete is carried up on sides of the skylight and ventilating frame that project above this roof. This roof has been in position now for a considerable length of time and has given perfect satisfaction, and is entirely water proof and fire proof.

SIEGEL-COOPER BUILDING, 18TH AND 19TH STREETS AND SIXTH AVENUE, NEW YORK CITY.



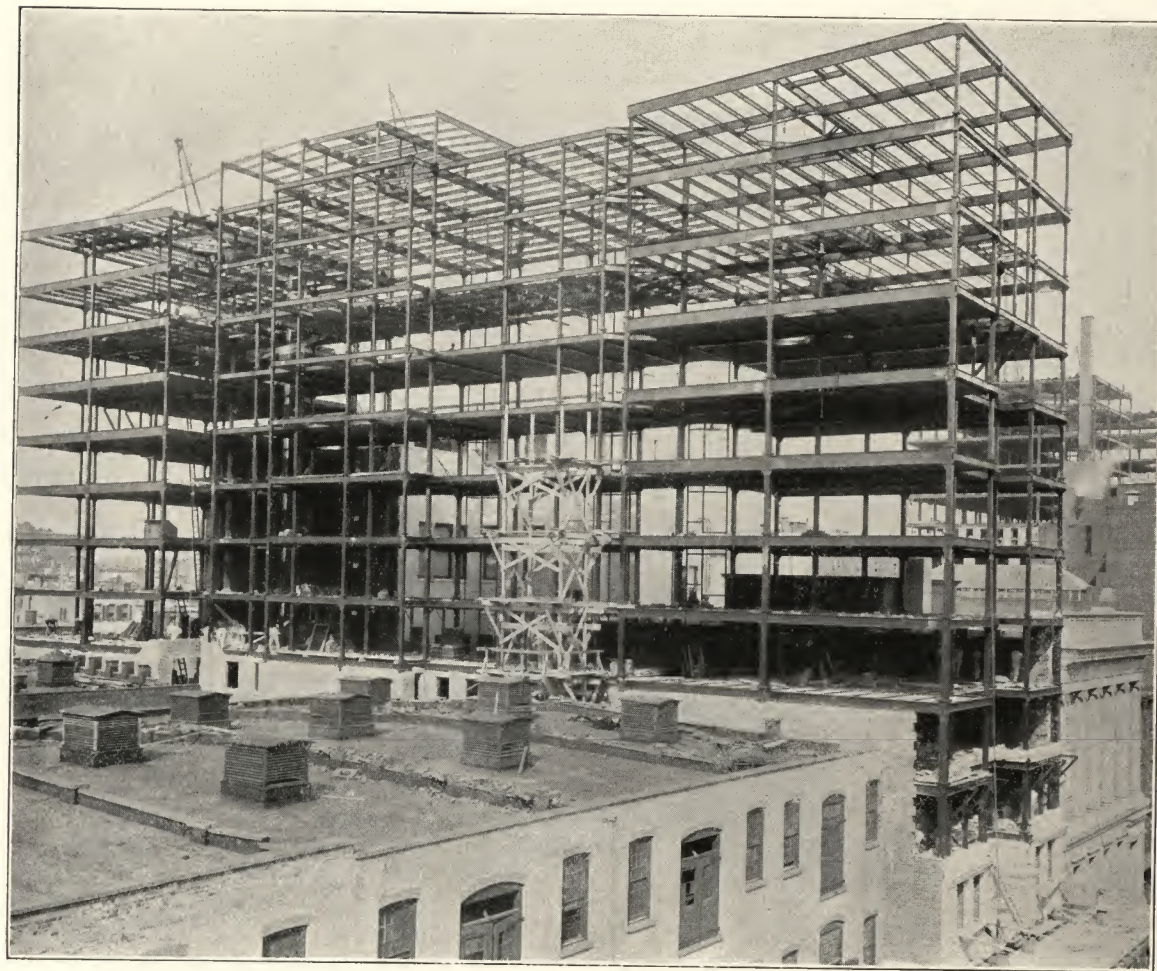
IRON AND STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HOTEL MAJESTIC, 72D STREET AND CENTRAL PARK WEST, NEW YORK CITY.



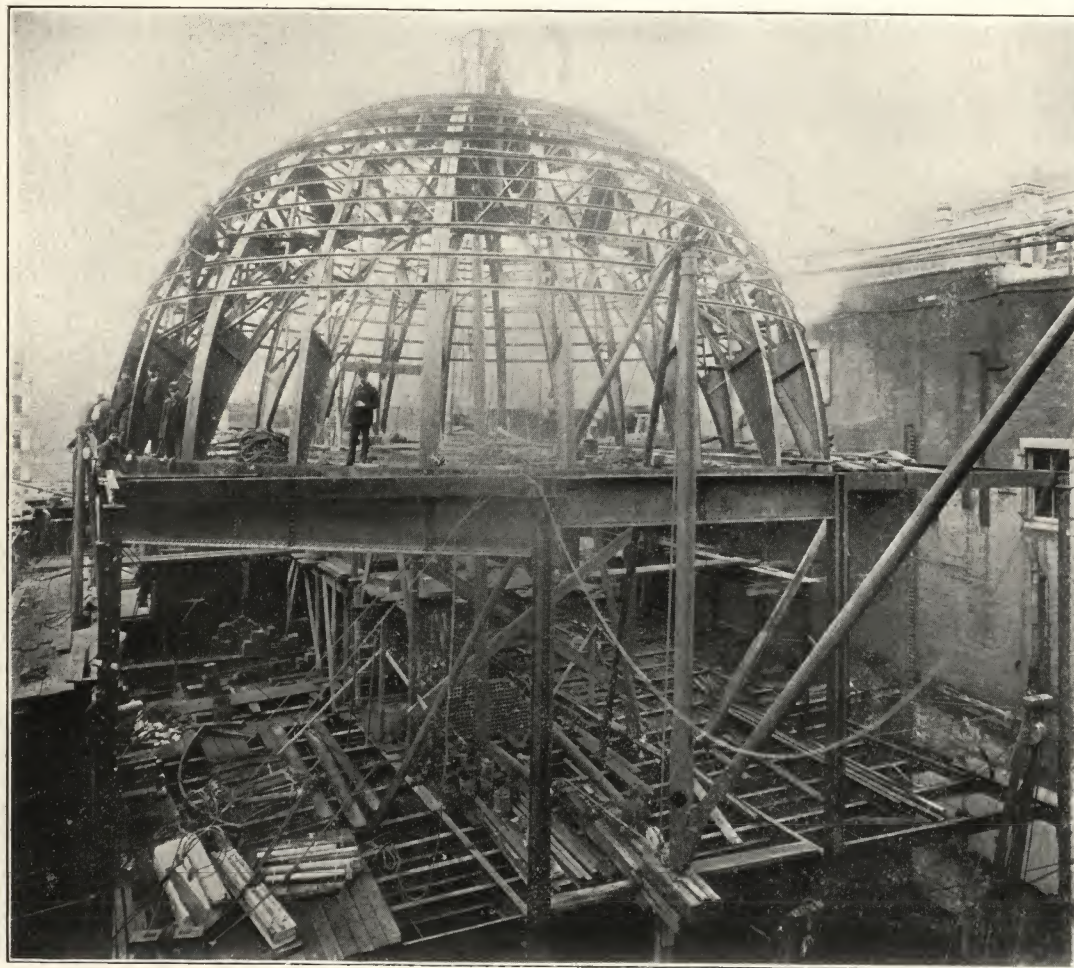
STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

HOTEL ROYALTON, 43^D STREET NEAR SIXTH AVENUE, NEW YORK CITY.



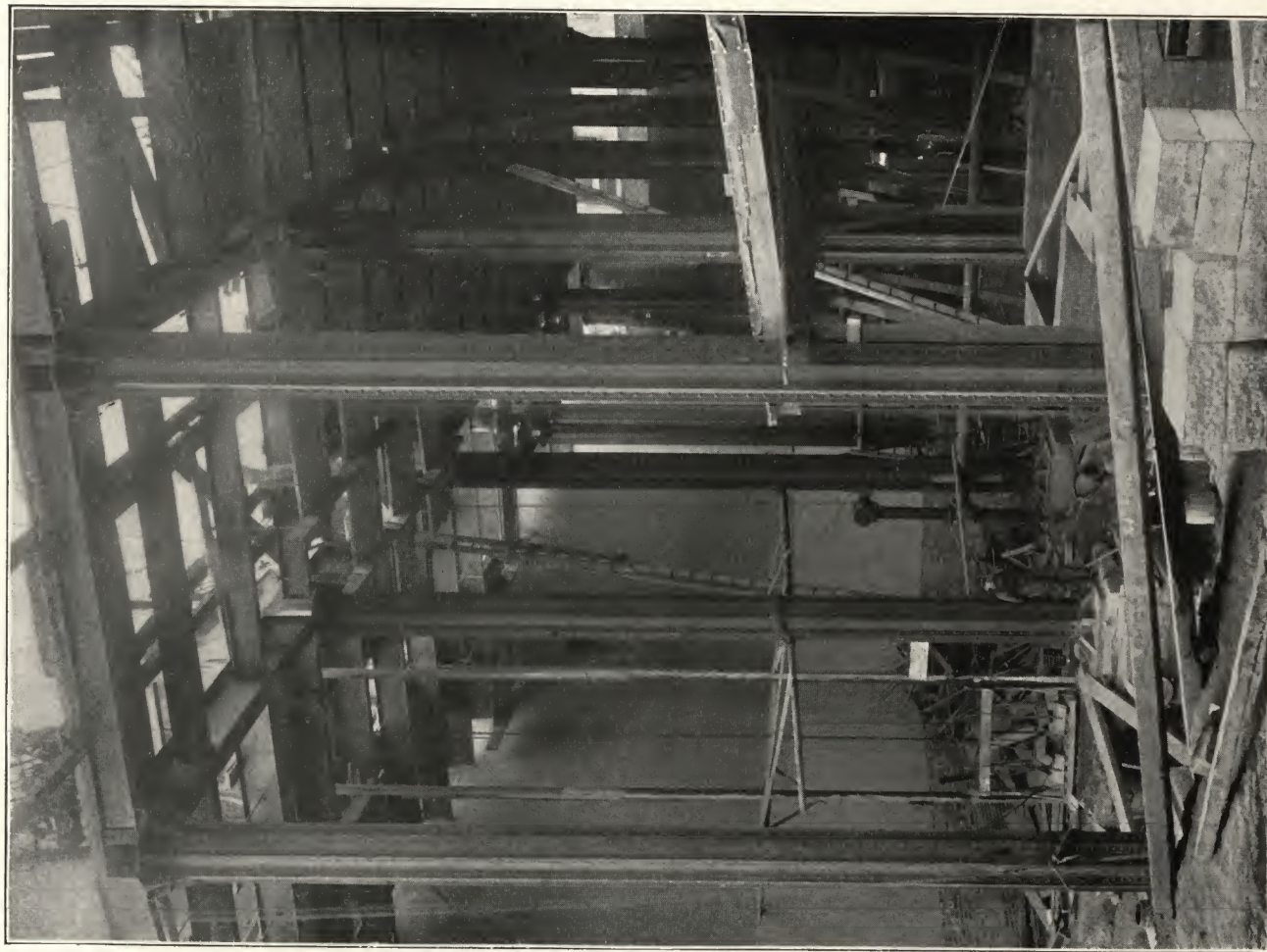
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DOME OF NEW YORK CLEARING HOUSE, NEW YORK CITY.



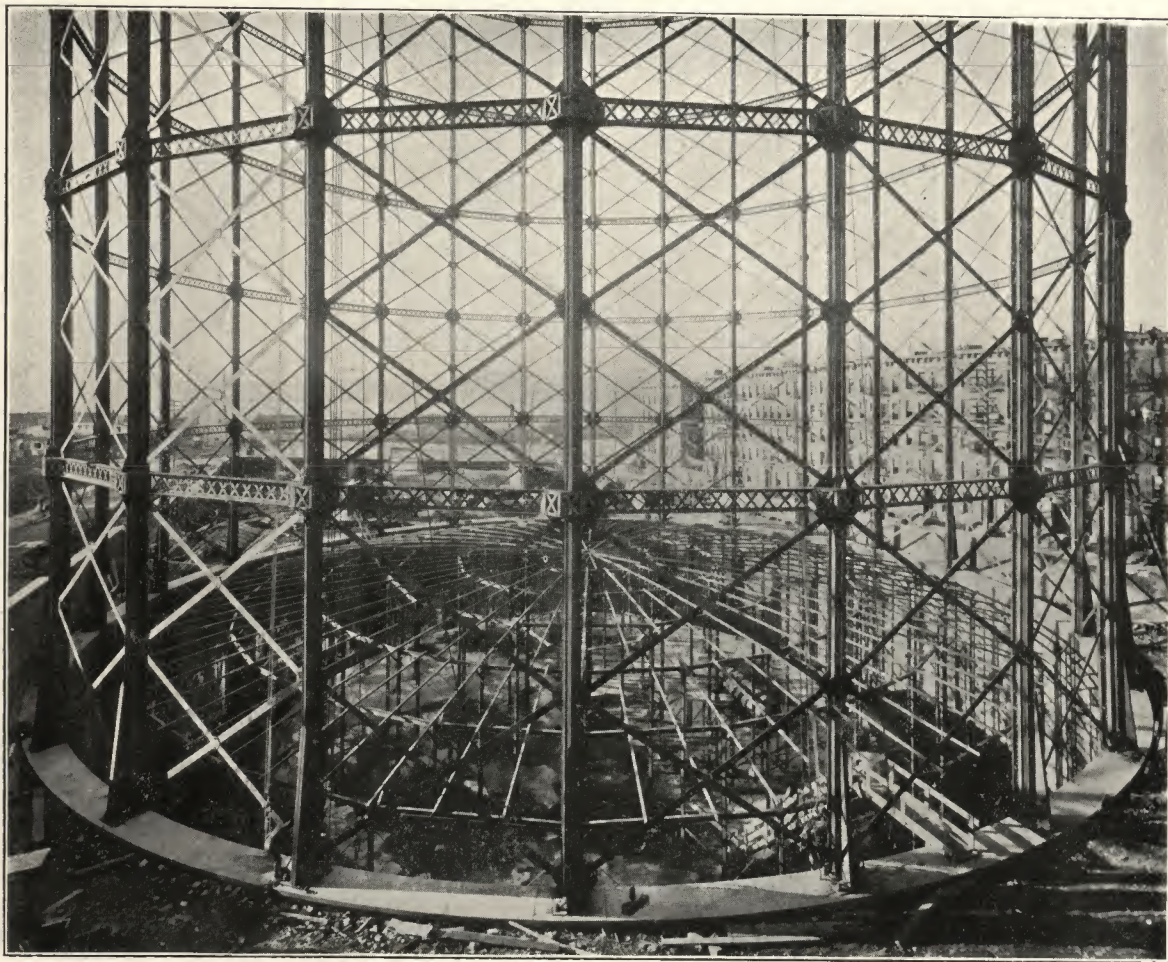
STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

PEARL STREET STATION, EDISON ELECTRIC ILL. CO., NEW YORK CITY.



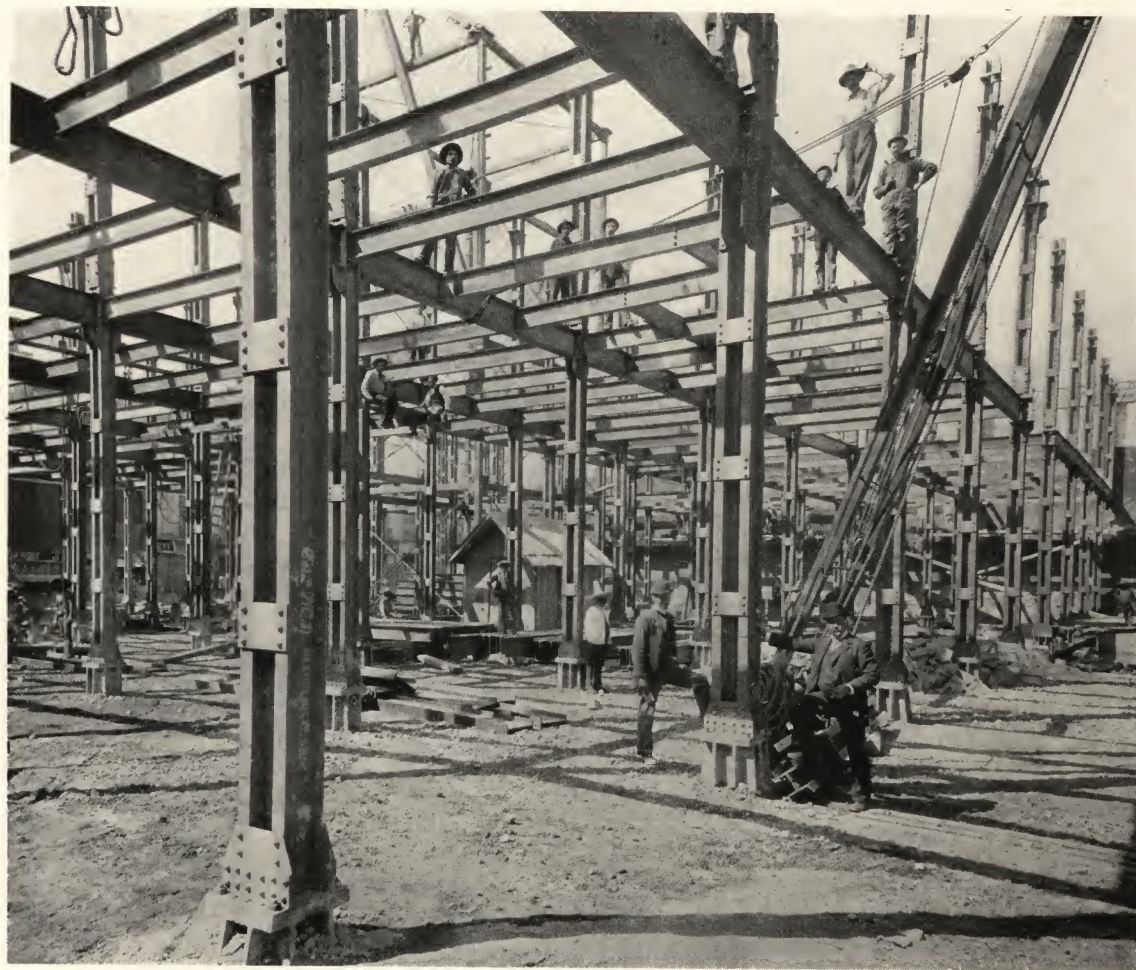
STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

GAS HOLDER GUIDE FRAME, NEW YORK CITY.



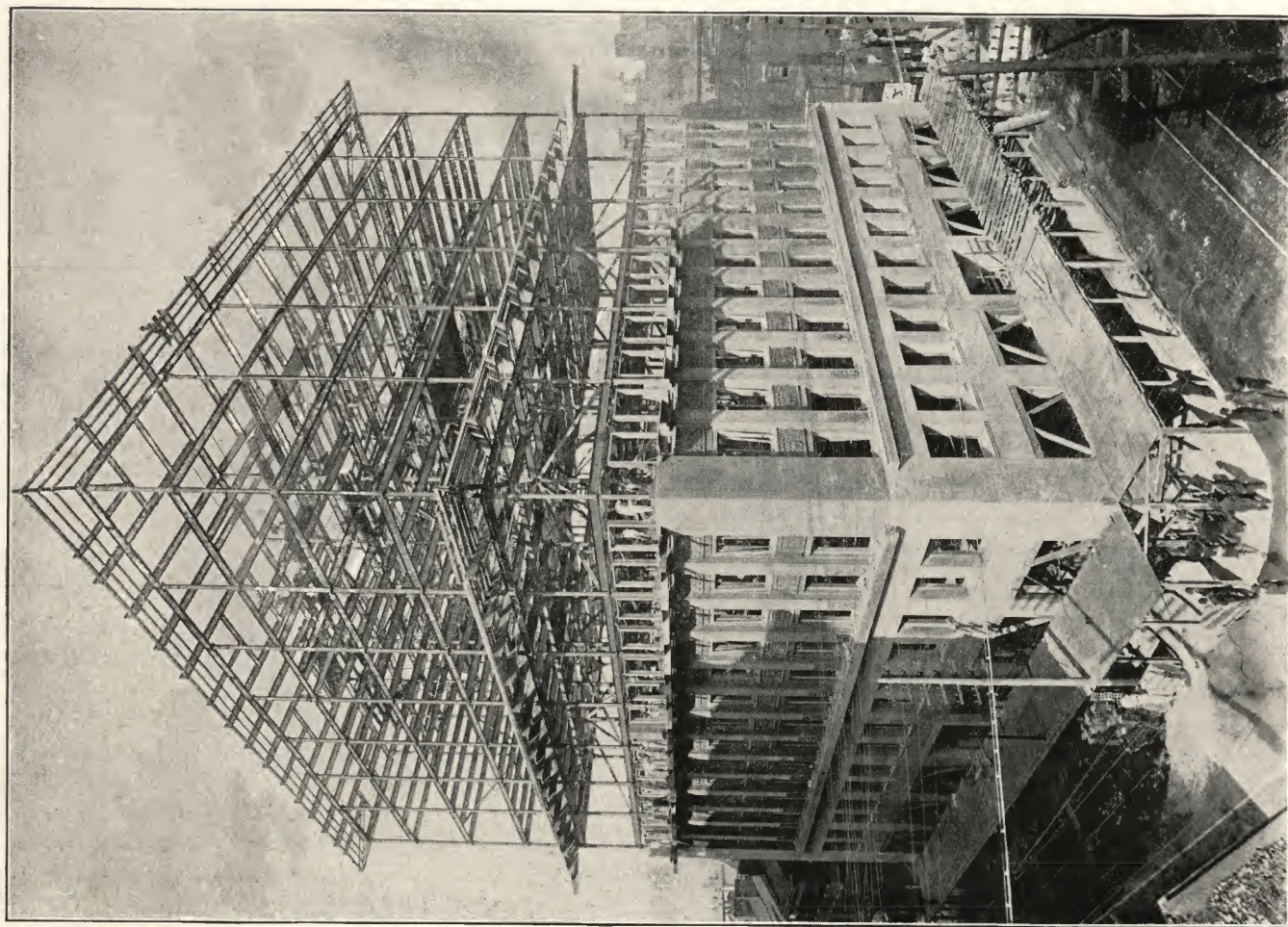
STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

R. BOKER & CO. BUILDING, MEXICO CITY, MEXICO.



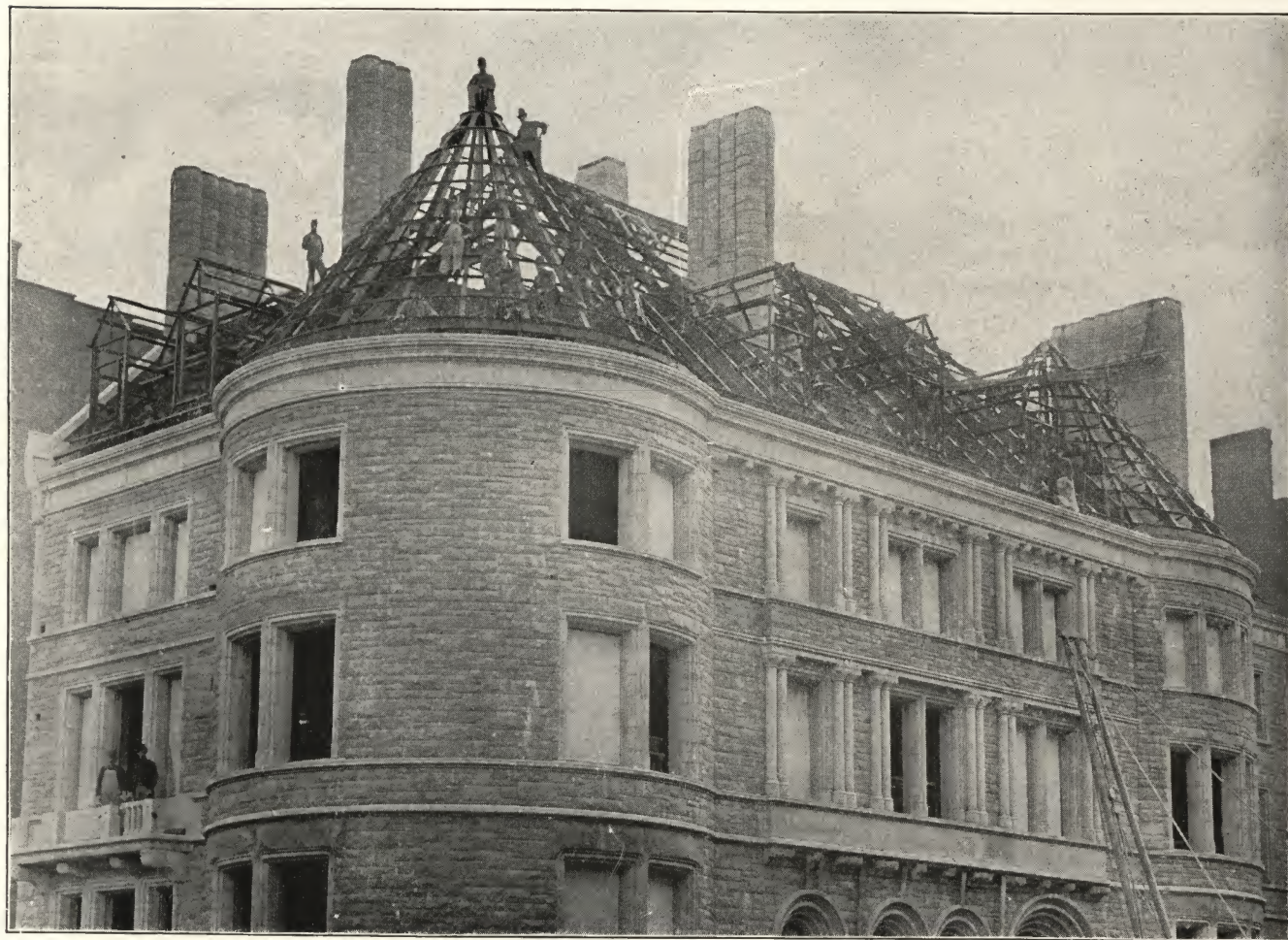
STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

WAINWRIGHT BUILDING, ST. LOUIS, MO.



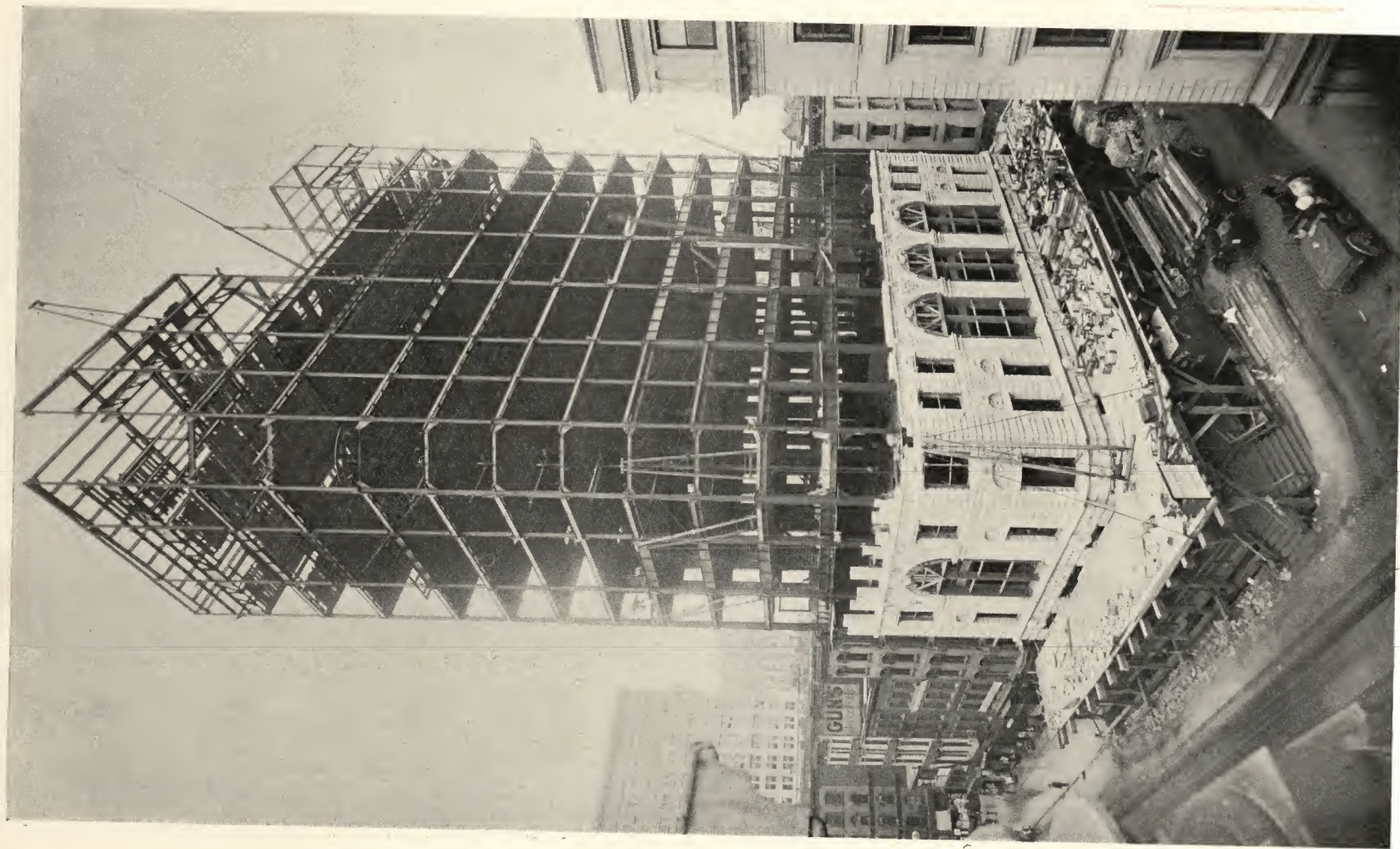
PHŒNIX COLUMNS SHOWING SKELETON CONSTRUCTION.

ROOF OF PRIVATE DWELLING, H. O. HAVEMEYER, NEW YORK CITY.



IRON WORK DESIGNED AND CONTRACTED FOR BY MILLIKEN BROTHERS.

R. G. DUN BUILDING, READE STREET AND BROADWAY, NEW YORK CITY.



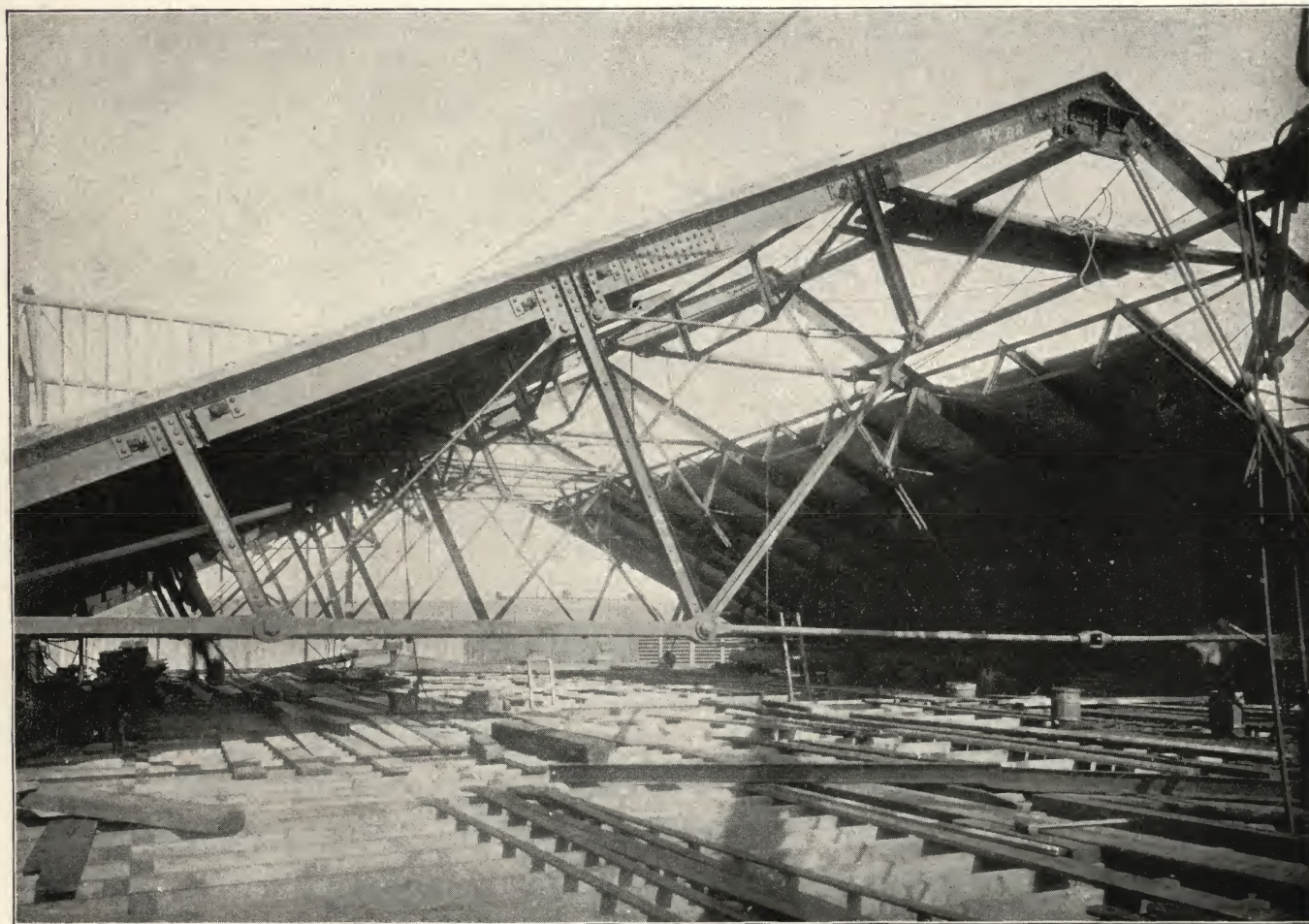
STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

R. BOKER & CO. WAREHOUSE, MEXICO CITY, MEXICO.



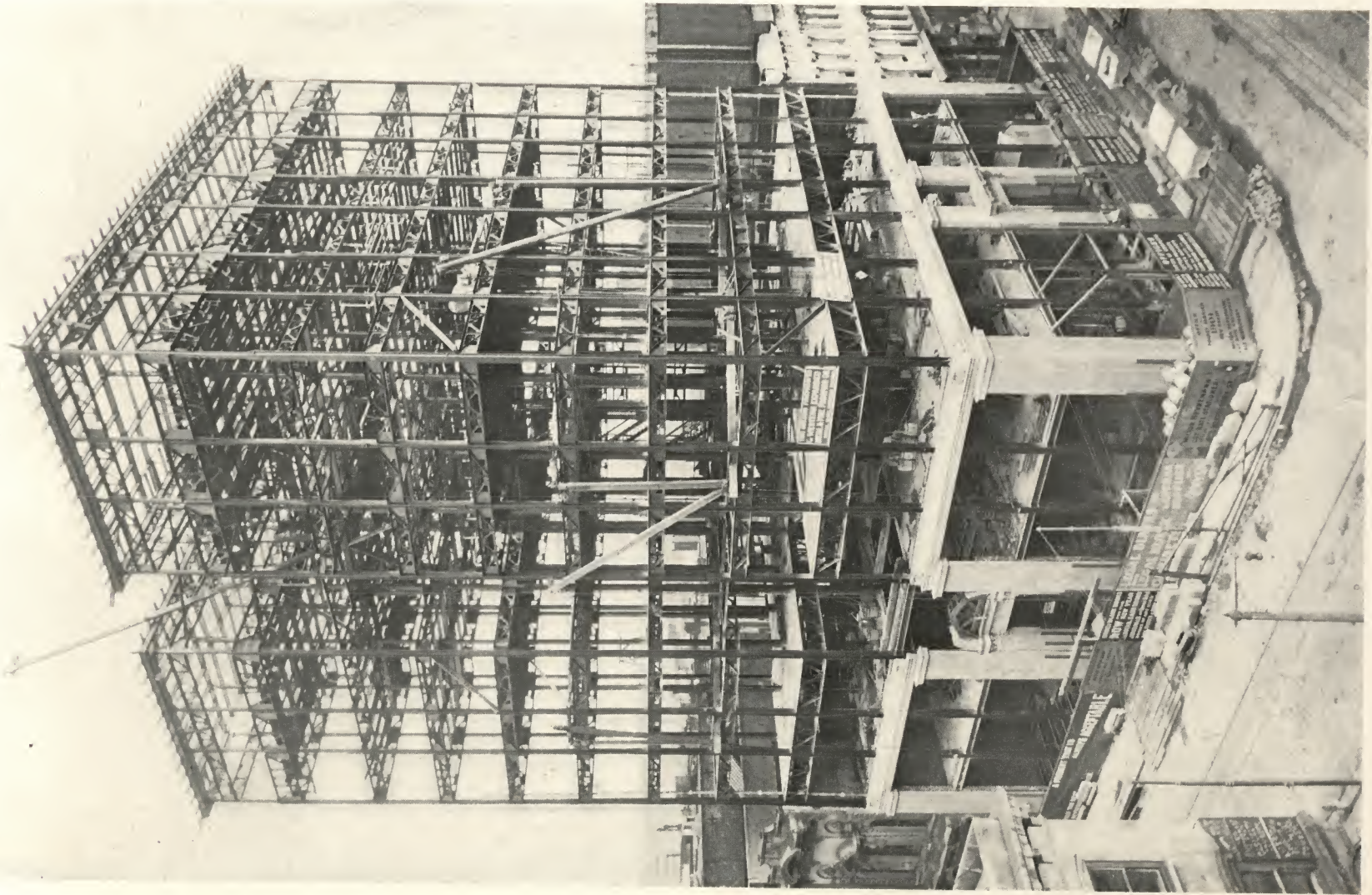
STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

LONG ISLAND R. R. CO.'s TERMINAL PASSENGER STATION ROOF, LONG ISLAND CITY, N. Y.



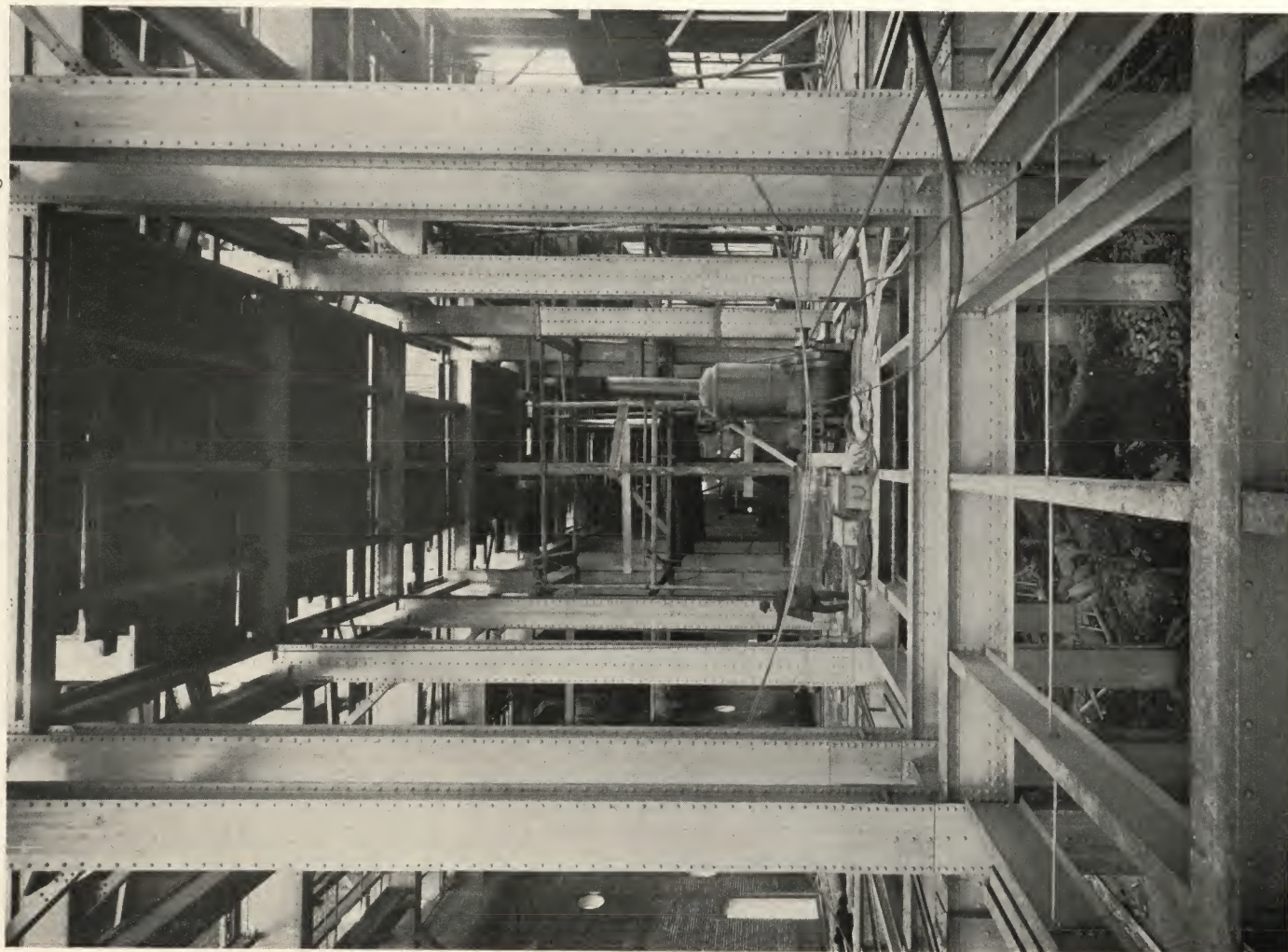
IRON WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HAYWARD BUILDING, SAN FRANCISCO, CALIFORNIA.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

WATERSIDE STATION, 38TH-39TH STREETS AND FIRST AVENUE, NEW YORK CITY.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

STORE BUILDING, PORT OF SPAIN, TRINIDAD.



STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

MANUFACTURING BUILDINGS, SHEDS, MARKET BUILDINGS, CEMENT MANUFACTORIES, ETC.

Owing to the low price of steel work it has been proven that roofs, and buildings in general can be constructed in nearly all cases as cheaply in steel as they can in wood, and have the additional advantages of being fireproof and much more durable. Probably the simplest form of this class of construction is passageways shown on Figure 2. Those are used for access from one building to another, or on docks or any other place where a covered passageway is required to protect either persons or goods from the weather. The roof is usually covered with corrugated galvanized sheet iron.

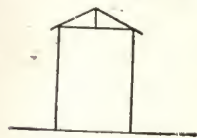


FIGURE 2.

Another simple form of construction is a shed over a sidewalk, as shown in Figure 3, which reaches from a building to the curb and is also used for the protection of persons and goods.

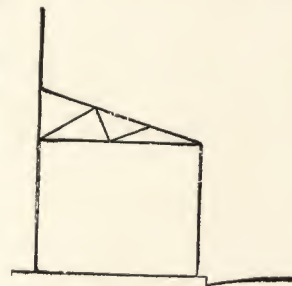


FIGURE 3.

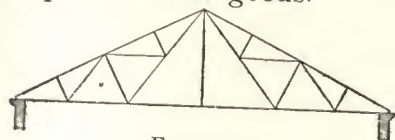


FIGURE 4.

A larger form of construction is for the roofs of buildings which have brick or stone walls as shown in Figure 4.

In buildings in which the walls are not of brick or stone but composed

of iron, it is often advisable to have projecting awnings, as shown in Figure 5, to protect the inside of the building from the weather, in cases where there are openings or doors in sides of building, especially when the main roof of the building is at any considerable height. The roofs in these cases are usually covered with corrugated galvanized sheet iron.

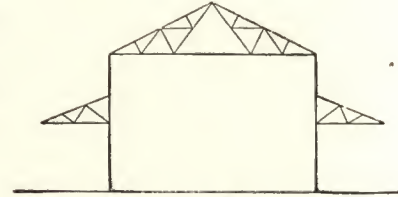


FIGURE 5.

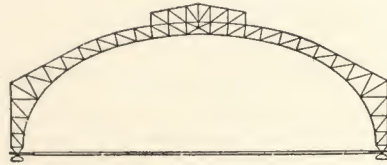


FIGURE 6.

The most complicated form in which steel is used for roof trusses is shown on Figure 6. Buildings of this class are generally used for Armories, Drill Halls, Railroad Depots and Exhibition Halls, or places where a large amount of space is required, with height between the floor and the truss, and at the same time unobstructed by any columns or supports. The form of truss shown in this Figure is known as the Three Hinge Arch Truss. The covering of these roofs is generally made of wood on which is laid tin, copper or some other weather protecting material.

Plate No. 43 shows a very economical and efficient design for a Railroad Station, which gives plenty of light and air, at the same time protecting the passengers and the cars from the weather. Many other designs could be given arranging for either more or less tracks than are shown on this plate.

We have made a specialty of designing and building, for a number of years past, machine shops, foundries and shops for the manufacture of all classes of goods. Plate No. 44, shows the design for a shop where heavy material is to be manufactured. The central or main span of the roof covers a traveling crane which is used for the moving of heavy material. In this country these cranes are universally moved either by hand for small manufactories, or in the larger works by electric power, which gives absolute and quick movement, and these cranes are made to lift almost any load. Many are

now in use which lift 100 tons (91,000 kilos). We are prepared to include in estimates for this class of work the cranes complete with all their mechanism. The crane is usually operated by one man who sits in a cage directly under the crane girders and operates the crane by means of levers and switches.

The side walls of these manufacturing buildings are often built of brick or stone as shown on Plate No. 44, but in many other instances we construct the sides entirely of corrugated galvanized sheet iron. The two leantos on either side of the main span are usually for the manufacture of lighter articles than those handled under the main span, and in some cases we design the buildings with an additional floor making two stories of this part of the building. For the easy movement of the goods under these leantos we usually furnish hand trolleys, by which the load can be raised or lowered from the floor by differential blocks and moved along the trolleys by hand, thus saving the labor of lifting them bodily and transporting them on trucks.

Several pictures appear in this catalogue of manufacturing buildings of this class, with both the single and the double floor underneath the leantos.

We have also given a great deal of attention to the designing and building of market buildings, especially for countries in warm climates. A view of such a market is shown on Plate No. 45. The frame of the building is constructed entirely of steel from the foundations up. The roof is covered with corrugated galvanized sheet iron, and the sides of the building are constructed of open iron work, with a panel of sheet iron work near the ground. The particular objects that we have in view in making the designs are perfect ventilation, and each part designed so that the market can be easily and quickly cleaned and all parts are arranged so that neither dirt nor refuse can accumulate and decay and thus cause trouble.

In furnishing this work we are prepared to furnish the construction of the stalls themselves for the sale of the goods together with the counters, cash drawers, etc. Also fountains, clocks and the other ornamental

and useful accessories that go with such a building. We are also prepared to furnish elevated water tanks so that water can always be obtainable to completely wash the market each day, all of which is fully explained, later on. Plate No. 46 shows a design for a building to be used for various purposes where it is desirable to seat a large number of people and it is arranged so that each person will have a perfect view of the stage or centre of the building as the case may be. This form of building is so arranged that it has the advantage of being particularly adapted for the use of assemblies, conventions, theatre performances, circuses, athletic games, bull fights, etc. The stage is usually located at one end of the building but is so constructed that it can be removed when desired. The centre of the building or main floor is arranged with seats when the performance is taking place on the stage, but when used for a circus these seats are removed. At least two or more balconies of seats can be arranged around the sides of the building. In front of these seats, stalls for the accomodation of a number of people in one party can be arranged. Access to any part of the building can be had under these balconies without crossing the arena of the building. In case it is not possible to get light from the sides of the building, owing to adjoining buildings ample light can be afforded from the roof.

We have lately made a specialty of designing and constructing buildings for the manufacture of cement. On pages 136, 160 and 161 will be found views of some of these buildings. We wish to call your particular attention to the part of this Catalogue devoted to the subject of tanks and the photographs shown in connection with this work on page 175. Nearly all the manufactories of cement require large tanks for the storage of rocks, cinders, ground cement, coal, etc., all of which class of work is manufactured by us.

Plate No. 43.

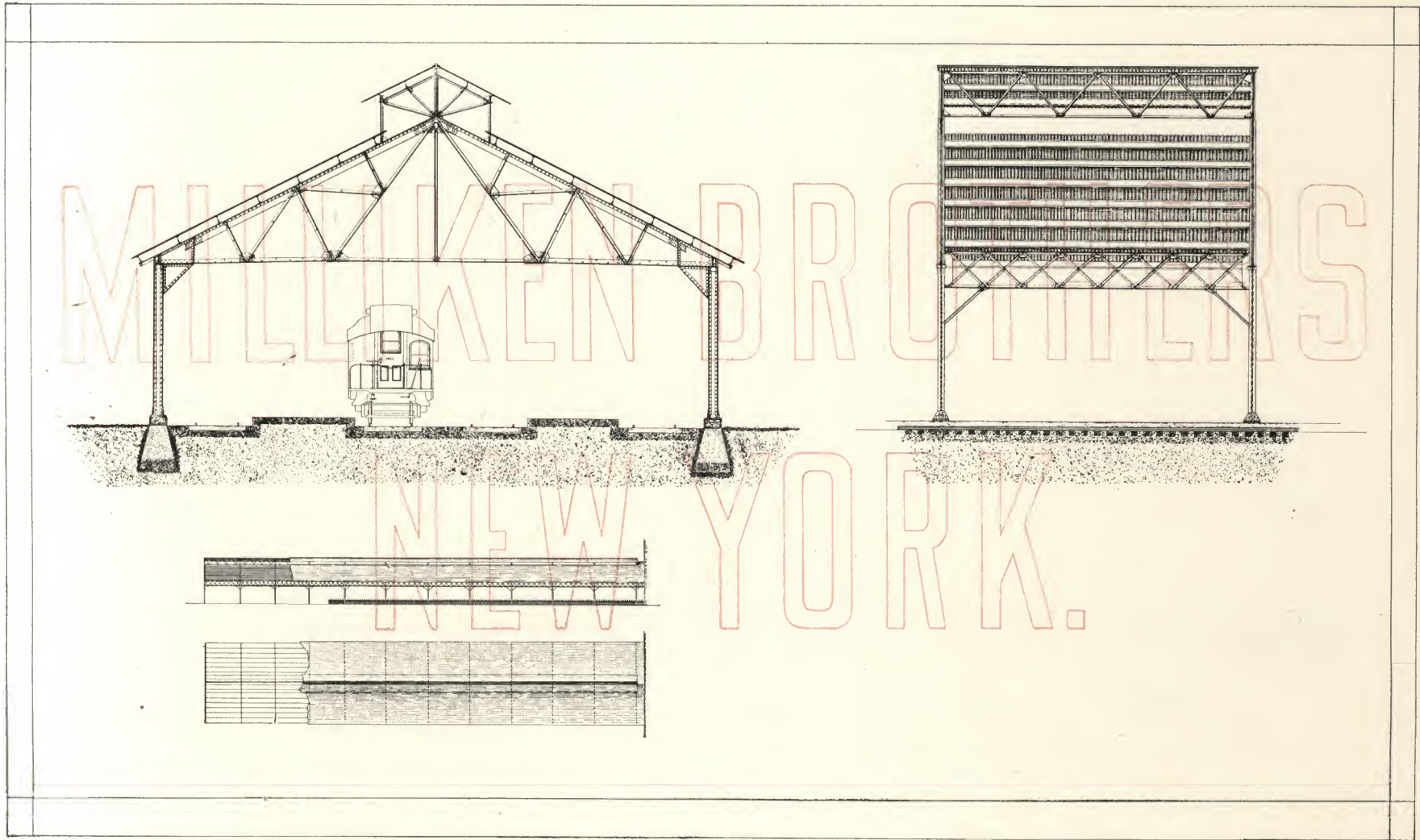


Plate No. 44.

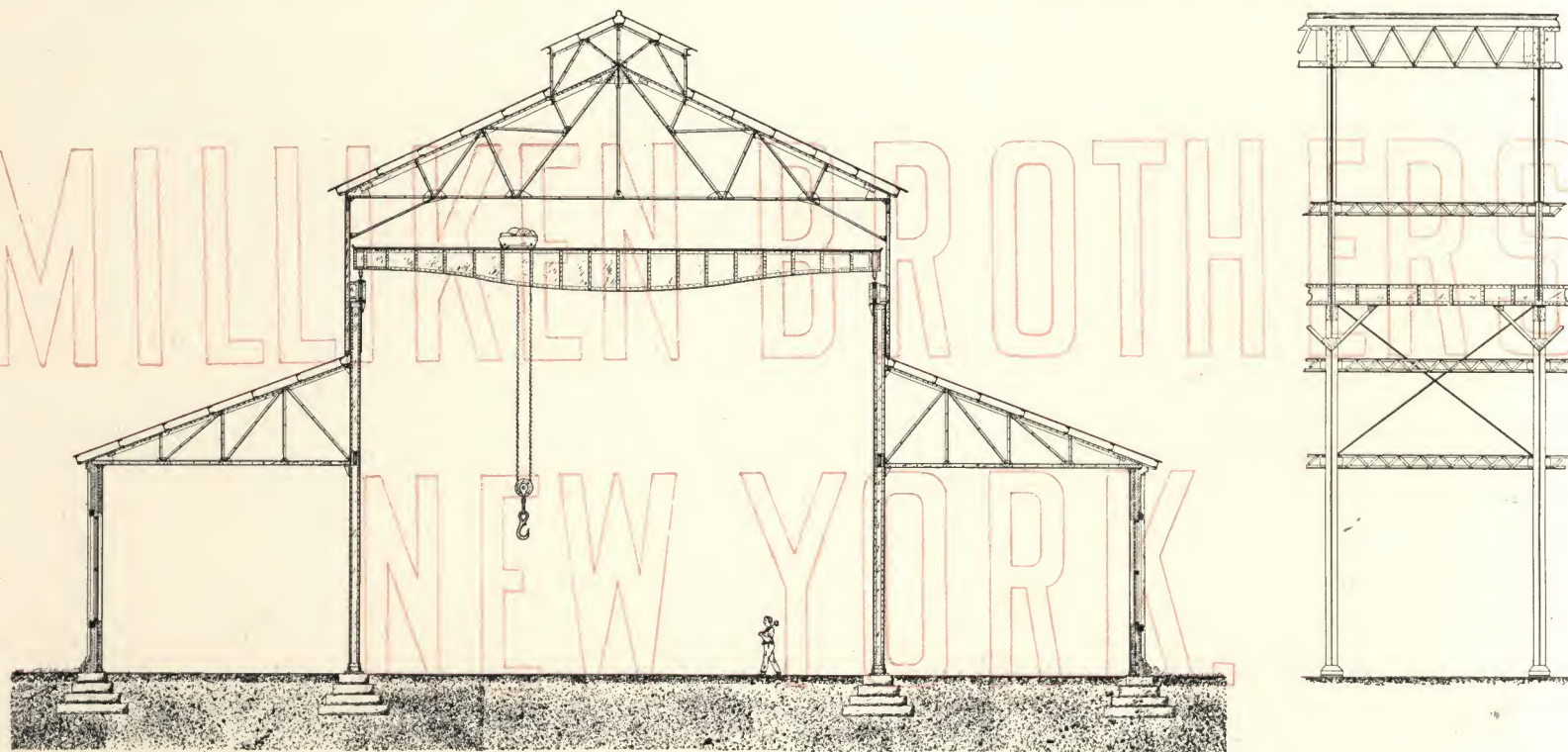


Plate No. 45.

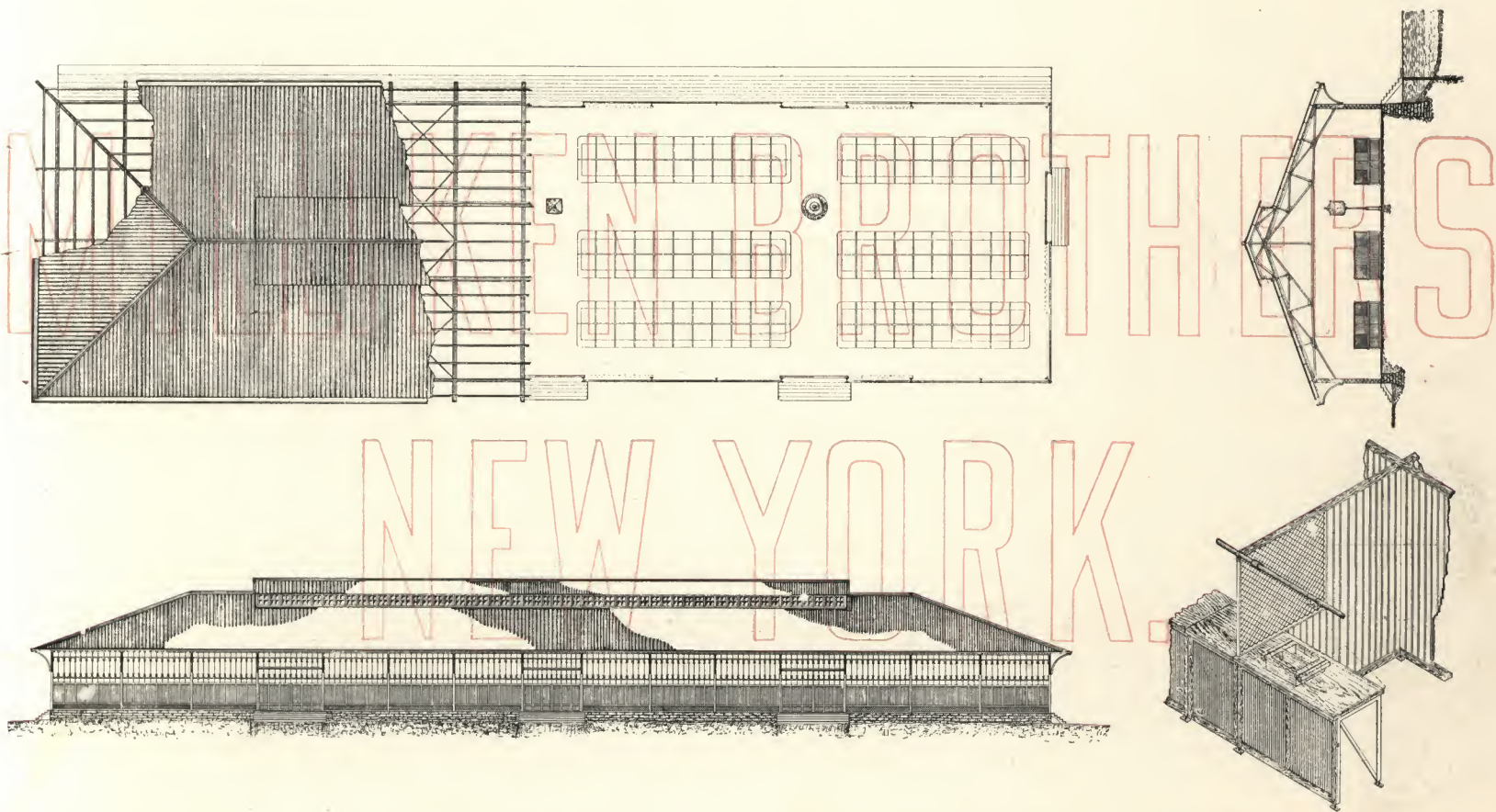
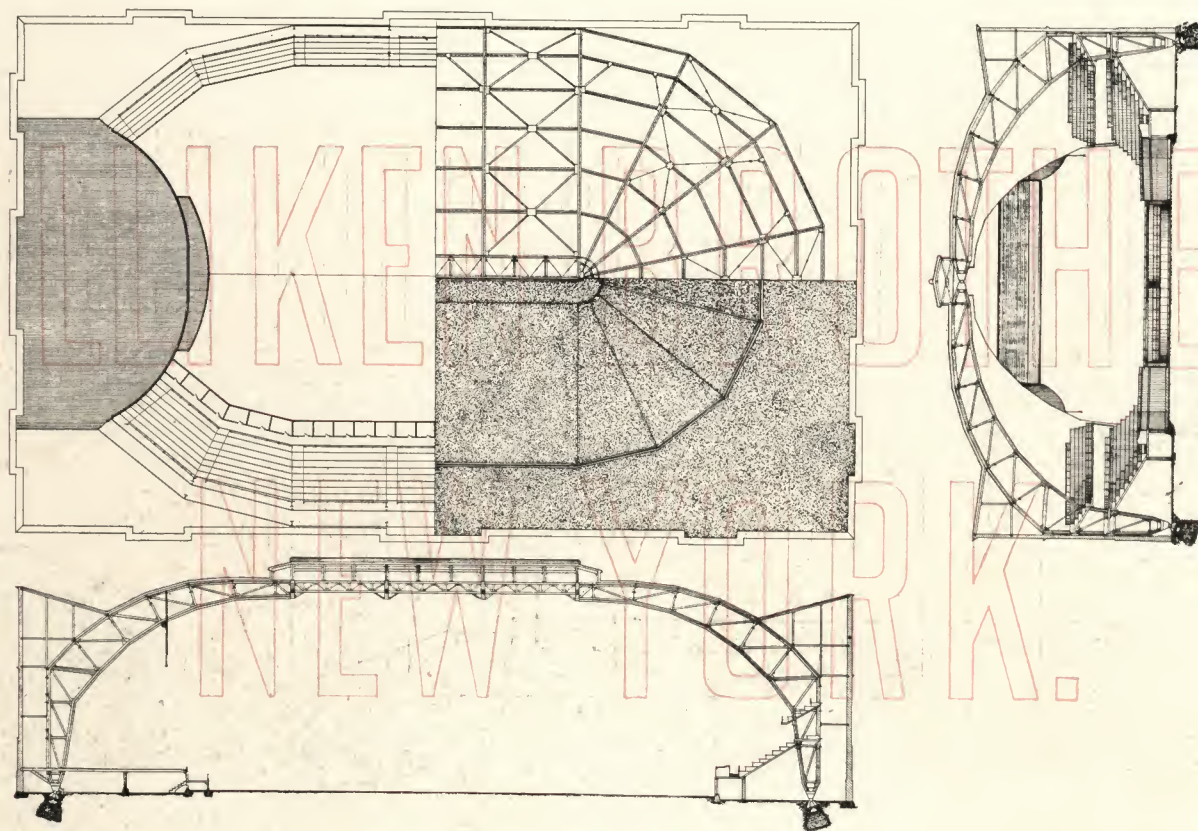


Plate No. 46.



INGERSOLL SERGEANT DRILL CO. MACHINE SHOP, EASTON, PA.



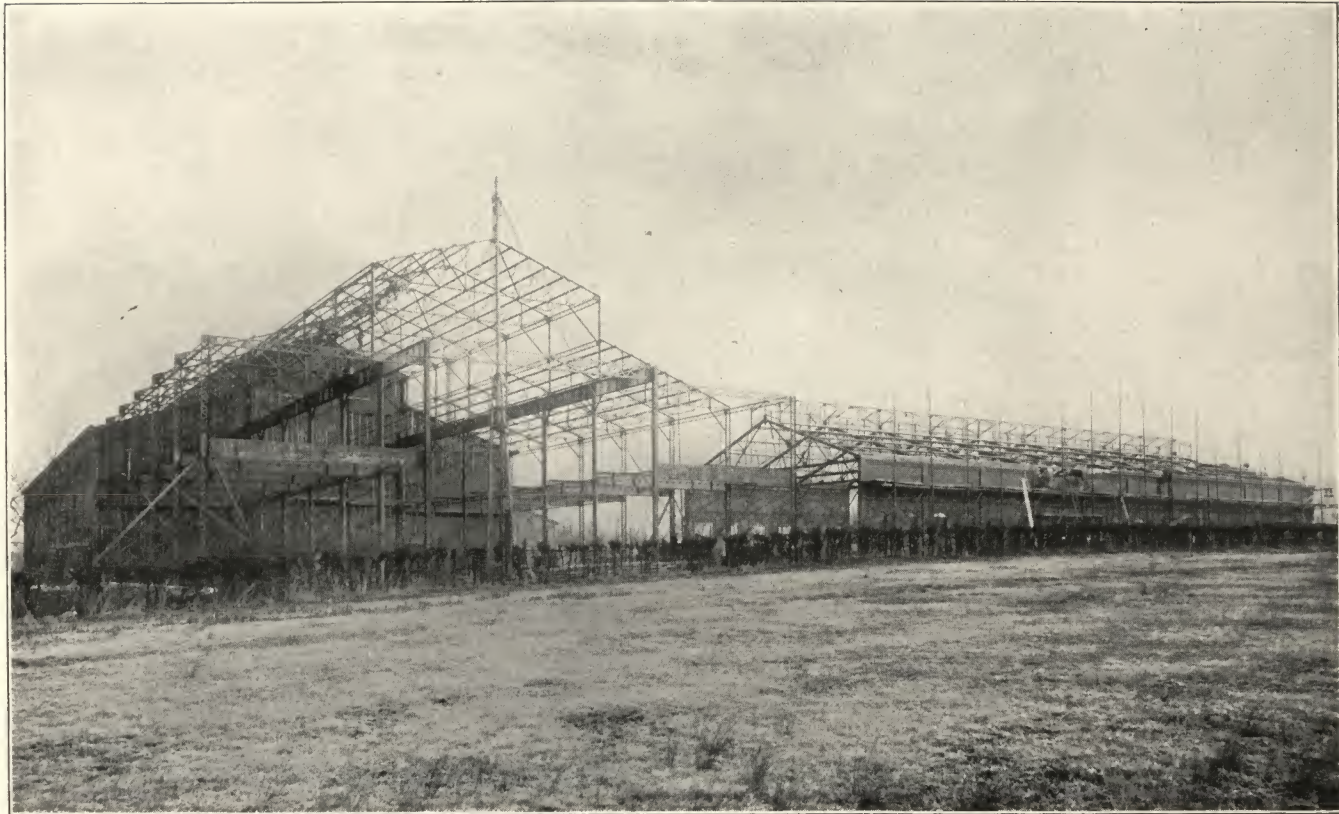
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

EDISON ELECTRIC ILL. CO., 66TH STREET POWER STATION, BROOKLYN, N. Y.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

SPRAGUE ELECTRIC CO.'S MACHINE SHOP, WATSESSING, N. J.



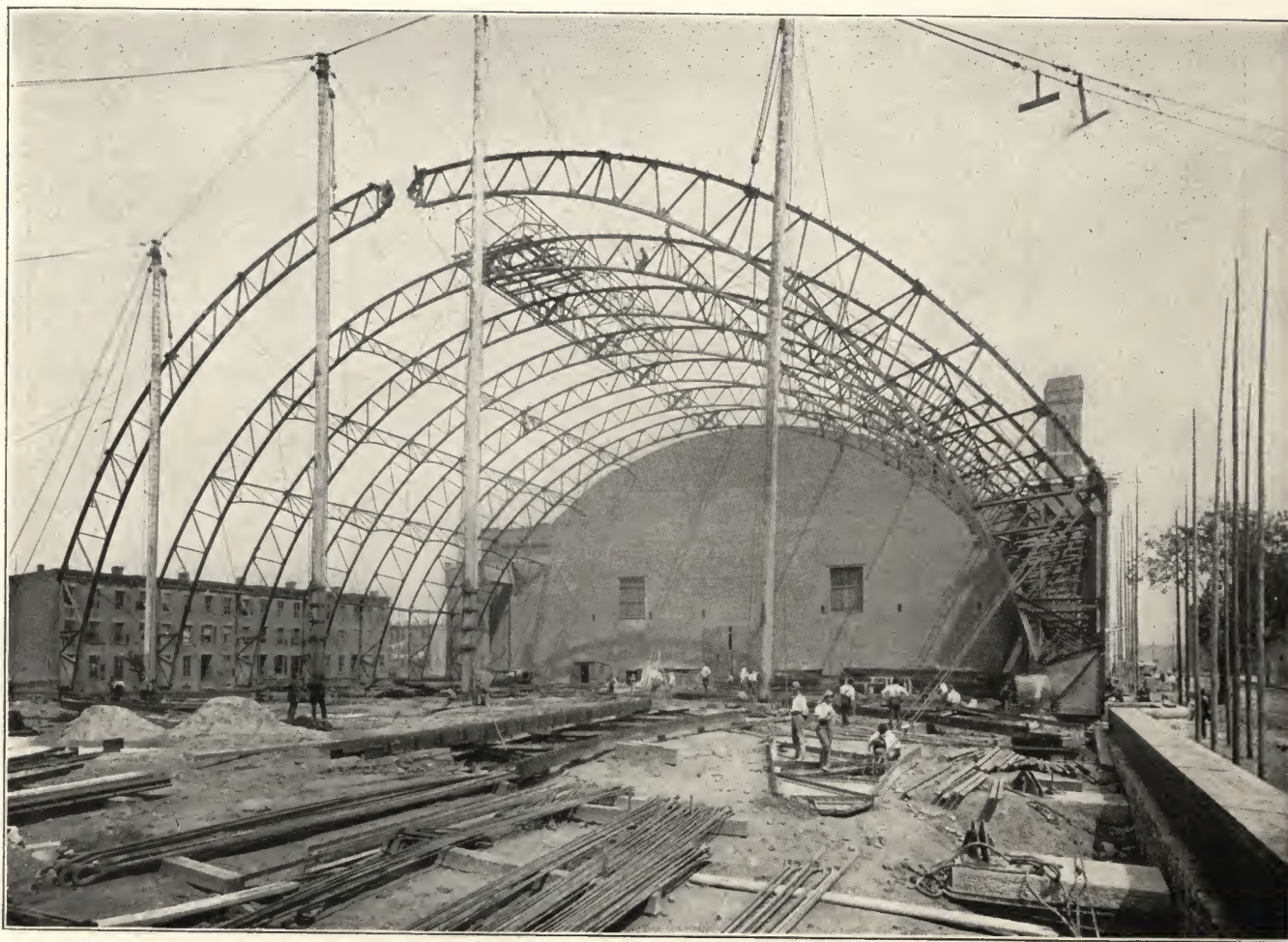
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

13TH REGIMENT ARMORY, BROOKLYN, N. Y.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

14TH REGIMENT ARMORY, BROOKLYN, N. Y.

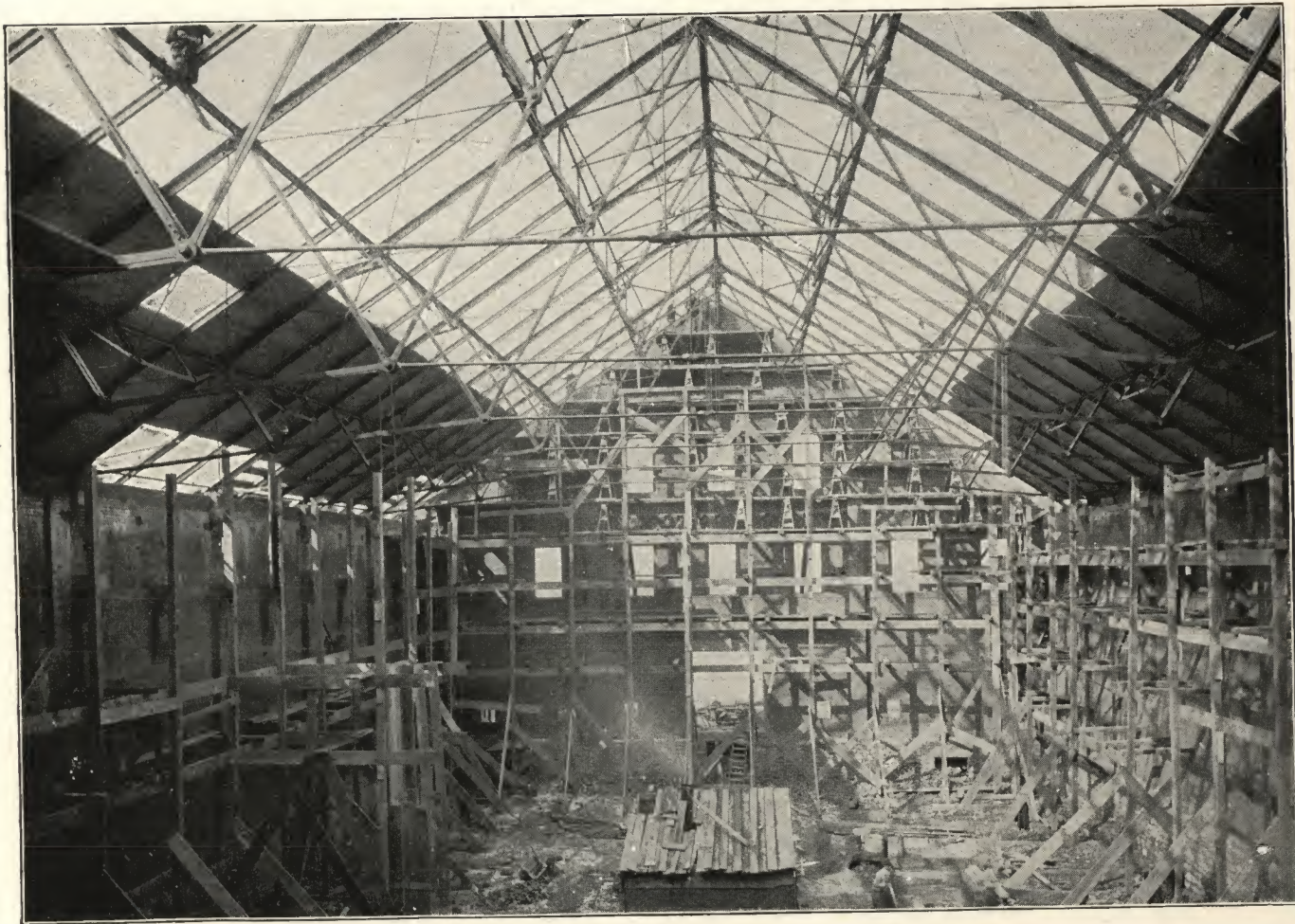


STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

ATLAS PORTLAND CEMENT CO. PULVERIZER BUILDING, NORTHAMPTON, PA.

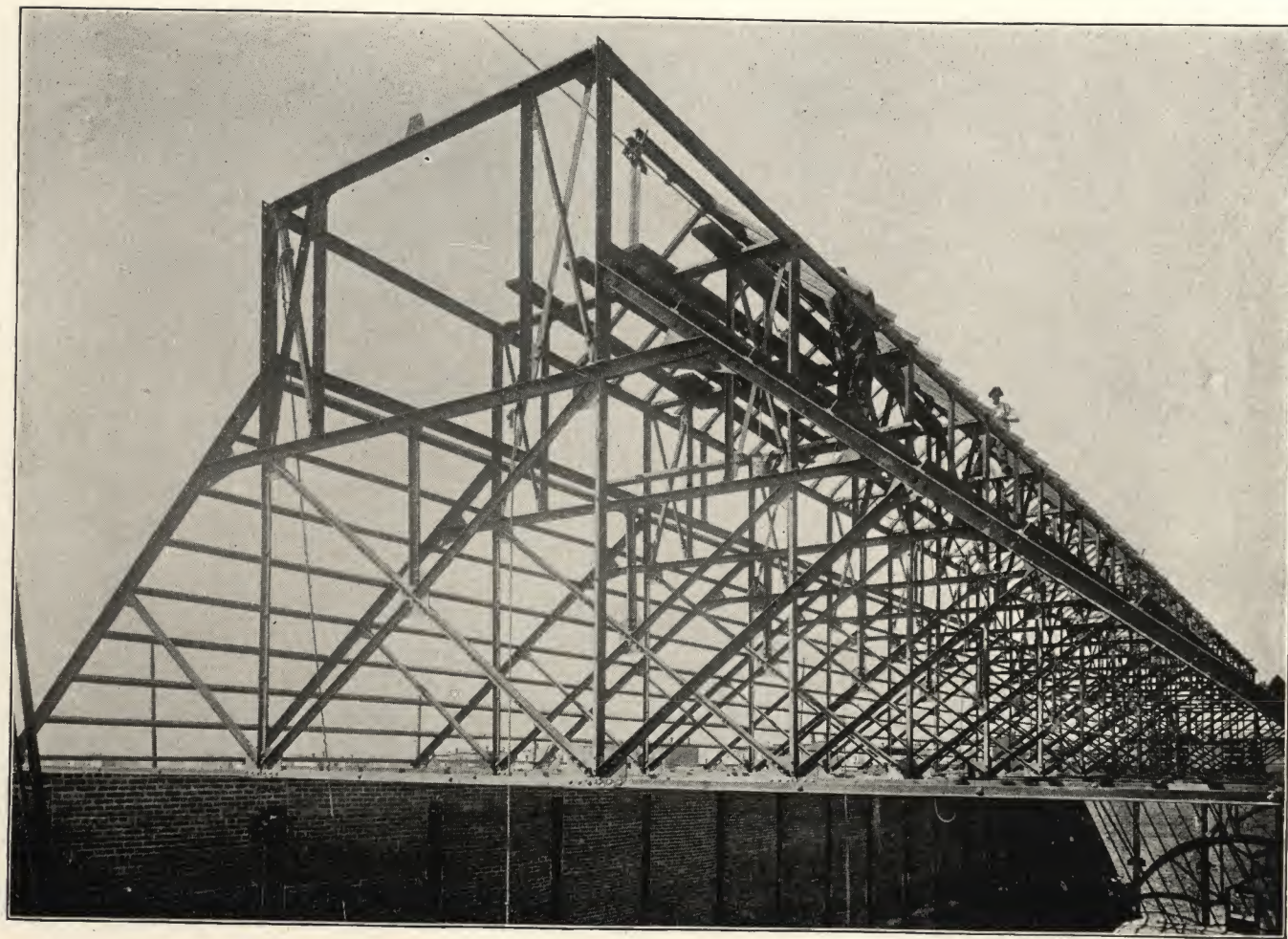


STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

BROOKLYN WATER WORKS COAL STORAGE HOUSE, BROOKLYN, N. Y.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

WARREN FOUNDRY BUILDING, PHILLIPSBURG, N. J.



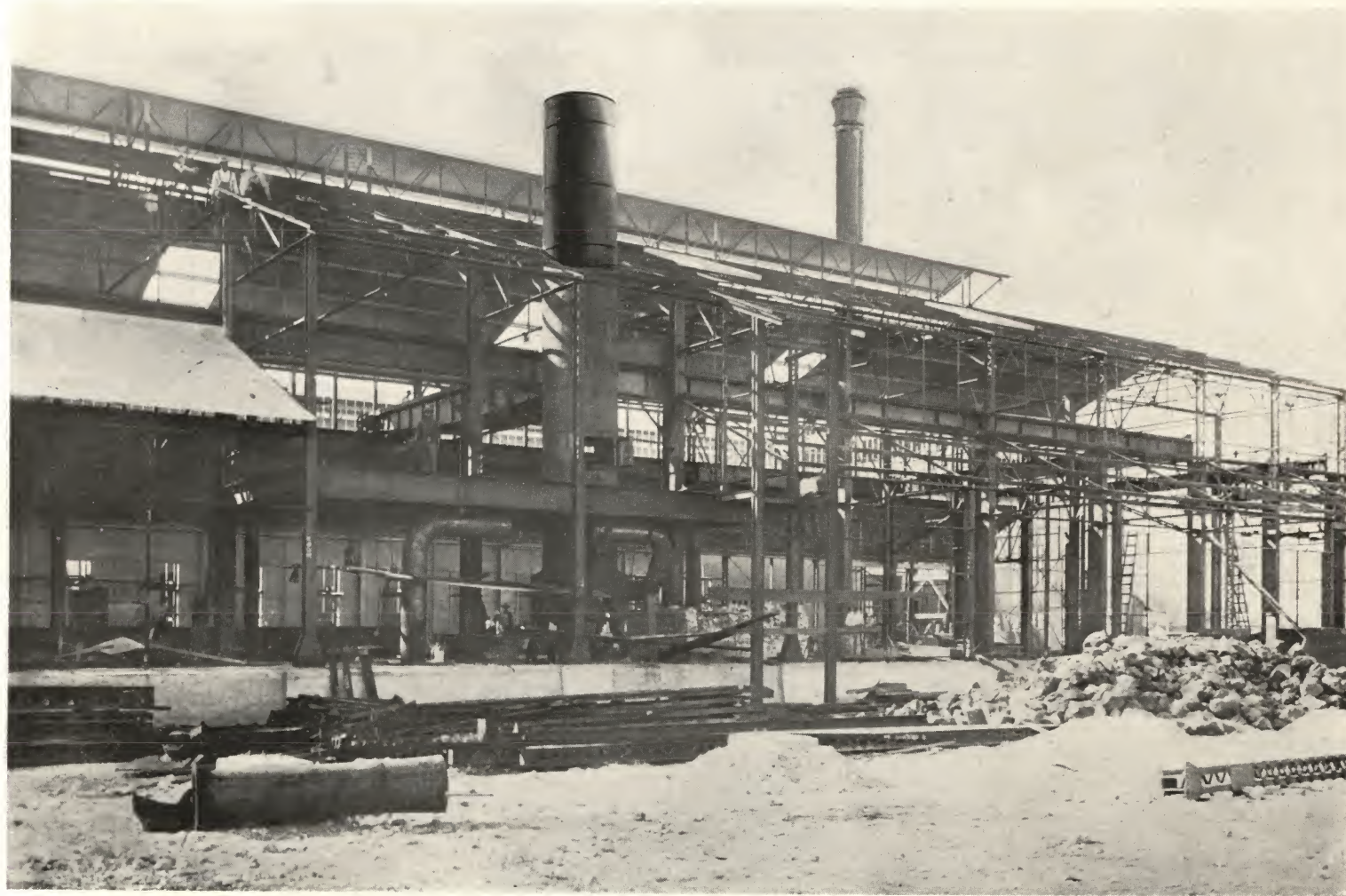
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

MILLIKEN BROTHERS' BRIDGE SHOP NO. 3.



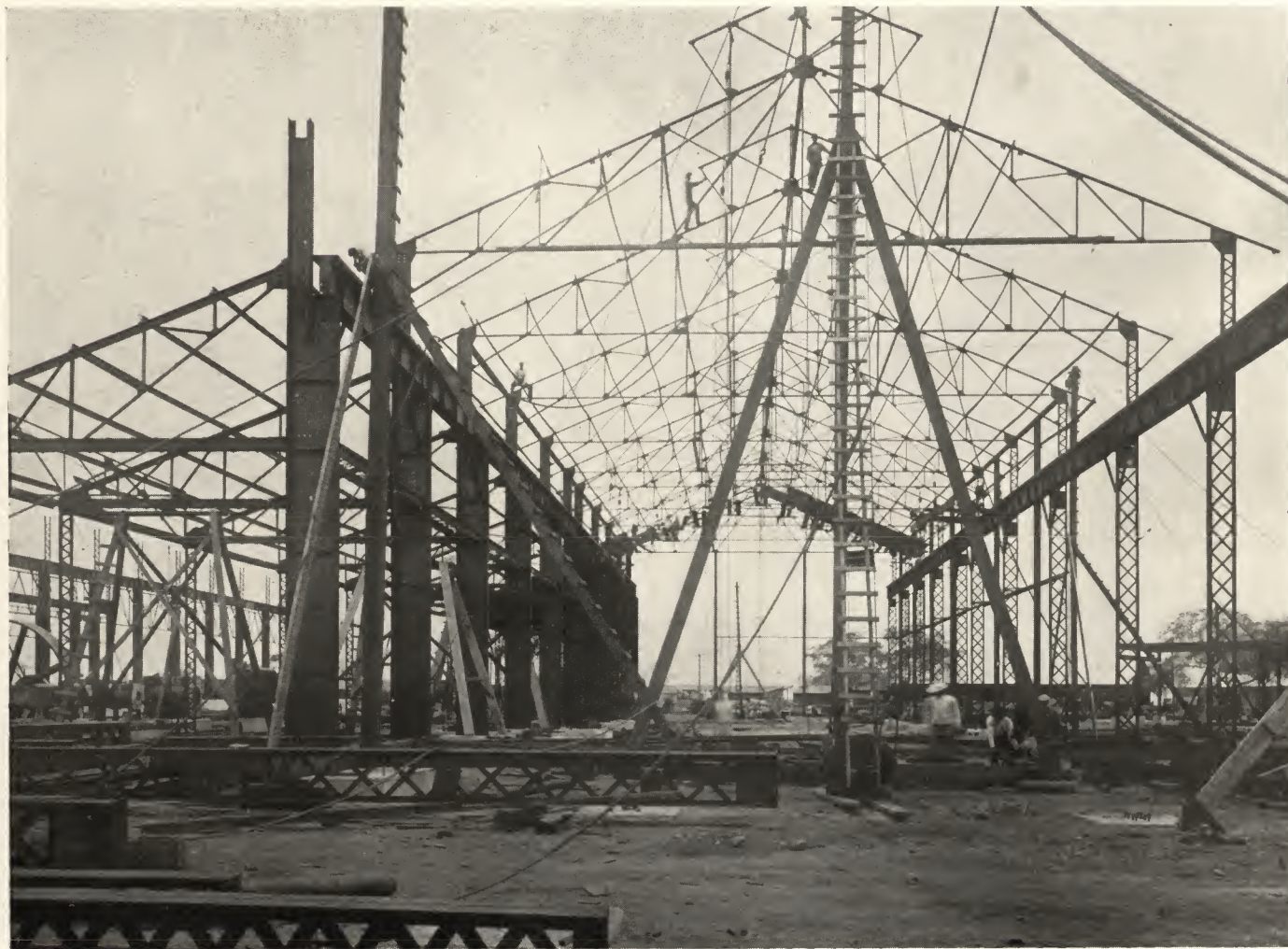
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HONOLULU IRON WORKS FOUNDRY BUILDING, HAWAIIAN ISLANDS.



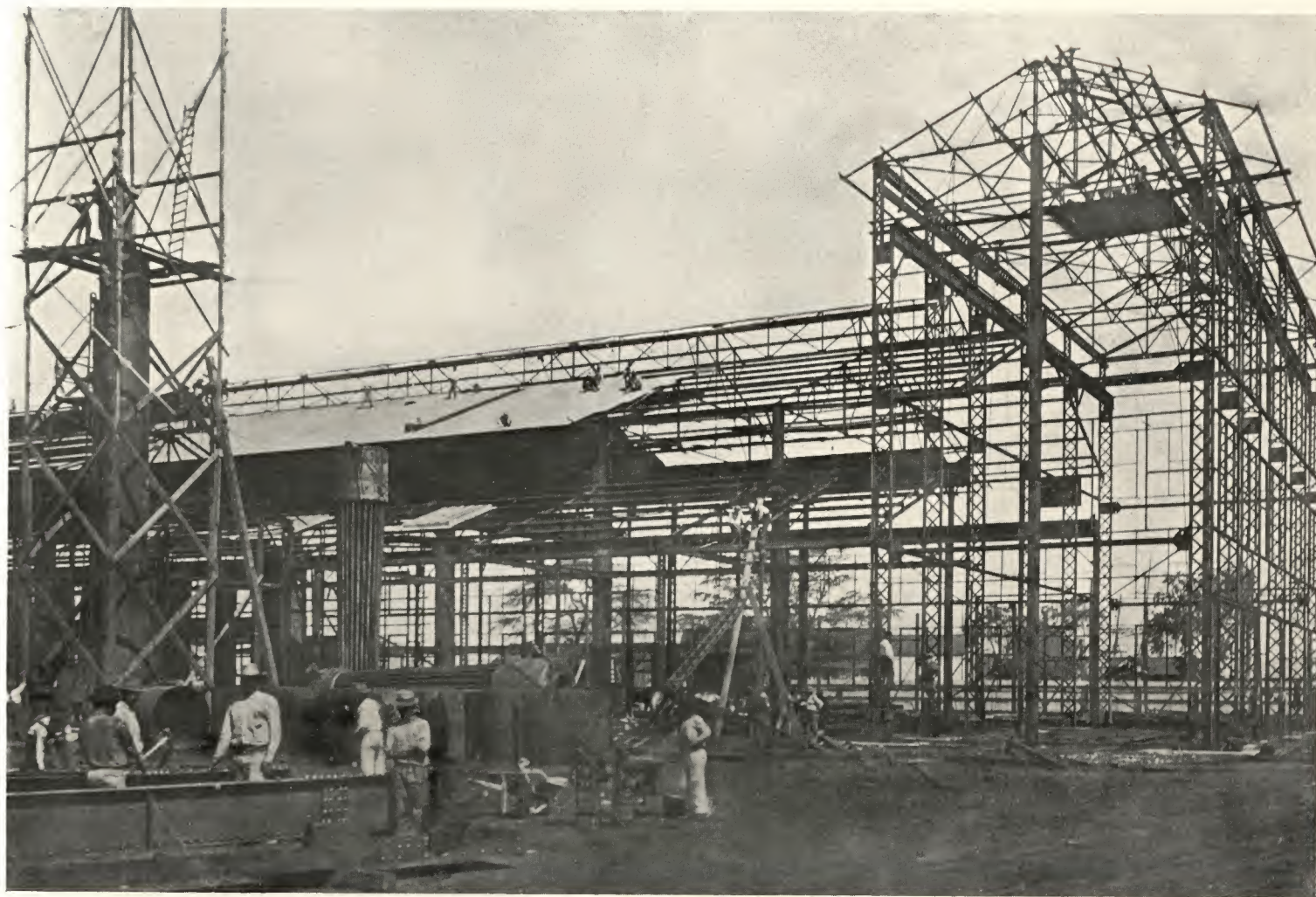
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HONOLULU IRON WORKS MACHINE SHOP, HAWAIIAN ISLANDS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HONOLULU IRON WORKS MACHINE SHOP, HAWAIIAN ISLANDS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HONOLULU IRON WORKS FOUNDRY BUILDING, HAWAIIAN ISLANDS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

CANE AND BEET SUGAR MILL BUILDINGS.

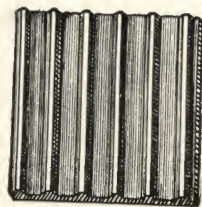
Probably no class of buildings demands greater attention, owing to the valuable machinery which they contain, than sheds and buildings covering Cane and Beet Sugar Mills; and probably no class of buildings is so liable to suffer from fire on account of the combustible nature of material stored in them and in their immediate vicinity. An owner can hardly estimate the loss and delay owing to fire, especially just before he is ready to grind, as such an accident means the loss of his entire crop in addition to the loss of his buildings and machinery. We have in a great many instances designed buildings to cover machinery already in position where the buildings were originally constructed of wood. In this case it is absolutely necessary

for us to have full information as to the exact position of the machinery so as to locate the columns and supports for the roof trusses and other members.

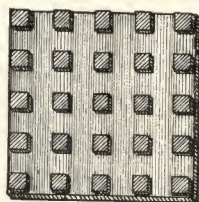
In addition to the structural steel work for the support of the roof trusses and the corrugated iron with which they are usually covered, we are prepared to design and furnish platform stands for all the evaporating and clarifying apparatus. These usually consist of wrought steel columns of the shapes already described in this catalogue. The floor itself is composed of steel I beams, and on top of this we recommend the use of rolled steel flooring plates as shown in Figure 7. These plates are made in three kinds,



Diamond Pattern.



Rib Pattern.



Checkered Pattern.

FIGURE 7.

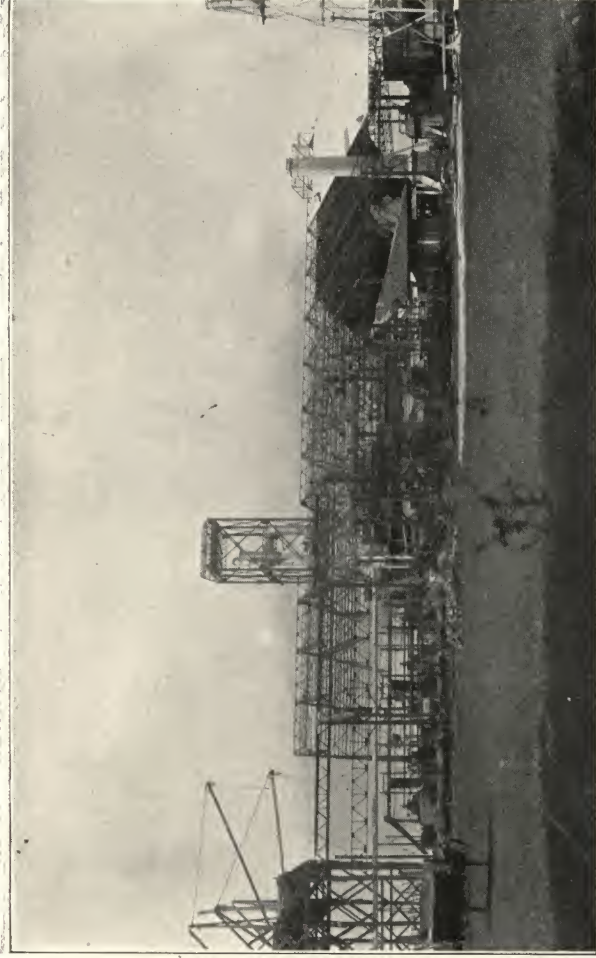
depending on the finish of the upper surface. As shown in this Figure, we make the upper surface finished in diamonds, straight corrugations and square checkers. The object of using a plate of this description is that the foot does not slip, as it would on a plain surface. These plates are made from $3/16$ inches (4.76 mm) thick up to any desired thickness.

These plates are also an excellent thing to use for boiler-room flooring. The plates of course are directly bolted to the beams already mentioned. In cases where the boiler room floors are on a level with the ground and not supported on a tier of beams, it is advisable to put bolts through the plates with washers on the underside and embed them in concrete. This is to prevent any movement and to hold the plates in place.

We are also prepared to estimate on and furnish all the staging and framing required for the support of the numerous machines used in sugar buildings like defecators, clarifiers, condensers, tanks, vacuum pans, crystallizers, centrifugals, etc.

In places where it is difficult to get running water for condensing purposes, cooling towers are universally used for cooling the water used in condensing so that it may be used over and over again. The different forms are very numerous owing to particular circumstances and fancies of the owners. We, however, recommend highly building the cooling tower in such a manner that the surface of water exposed to the air for cooling will be extensive. We are also prepared to furnish wrought steel troughs or aqueducts for carrying the water to the cooling tower and from the cooling tower to the sugar house.

The question of towers for tanks and the subject of traveling cranes for taking out and putting in the crushing and grinding rolls, also steel smoke stacks or chimneys, stairs and railings, are fully covered in the latter part of this catalogue.



SUGAR MILL BUILDING, YNGO. ELIZALDA, CUBA.
STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.



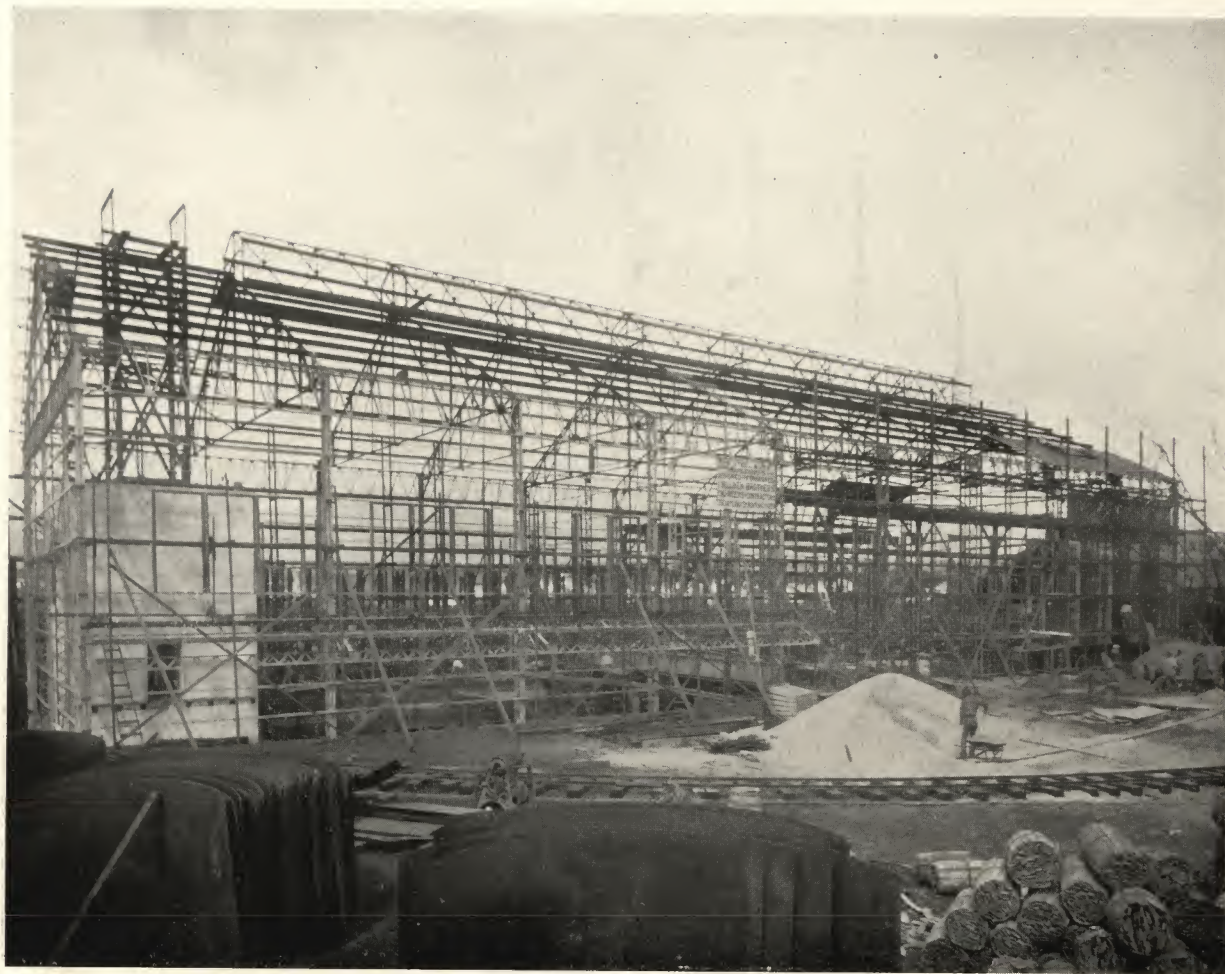
RIVETED BRIDGE, COLUMBIA, S. C.
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

AMERICAN BEET SUGAR CO. BOILER HOUSE, CHINO VALLEY, CAL.



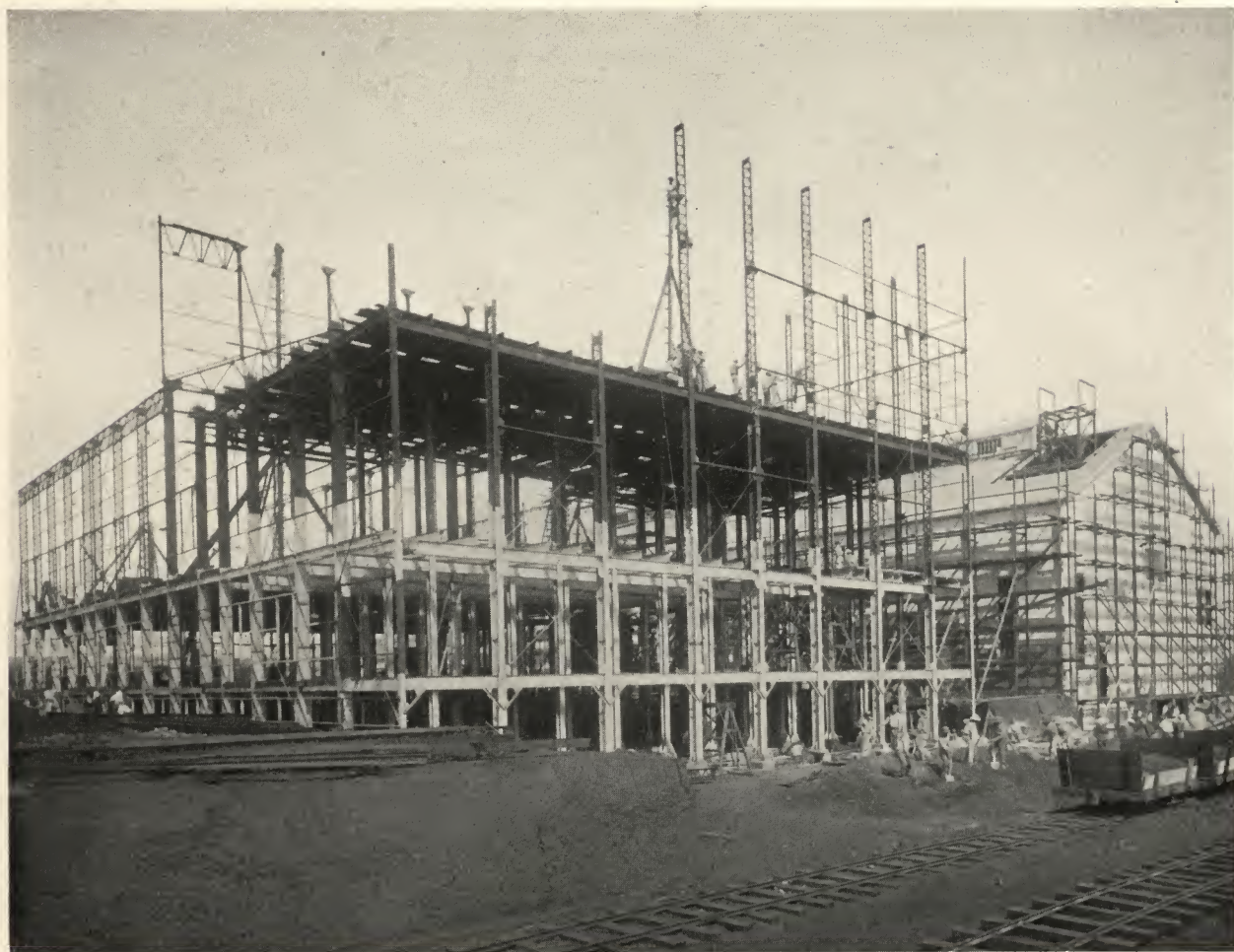
STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

OAHU SUGAR CO. BOILER HOUSE AND GRINDING MILL, HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

OAHU SUGAR CO. BOILING HOUSE, HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

OAHU SUGAR CO. CRYSTALIZER AND CENTRIFUGAL FLOORS, HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

OAHU SUGAR CO. CANE CARRIER SHED, HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

OAHU SUGAR CO. COMPLETE BUILDINGS, HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

WAIALUA SUGAR MILL, HAWAIIAN ISLANDS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

BANES SUGAR MILL, CUBA.



STEEL WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

WAIALUA SUGAR MILL, HAWAIIAN ISLANDS.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

SHEET METAL WORK.

The use of corrugated Galvanized Sheet Iron is becoming very general in Foreign Countries, owing no doubt to the fact of its very extensive use in this country. Plate No. 47 gives the thickness in inches and m/ms. for the corresponding guage number as used in the United States. In specifying for sheet iron work the guage number represents the thickness of the iron before it is galvanized. After it is galvanized it will increase in thickness about one-half the difference between the numbers given, for instance No. 22 United States Standard when galvanized will be intermediate in thickness between No. 20 and No. 22 before it is galvanized.

The centre part of Plate No. 47 gives the distance centre to centre of the corrugations, and also the approximate depth of the corrugations which, however, is liable to change slightly. In specifying for corrugated sheet iron the distance from centre to centre of corrugations is always given and not the depth of the corrugations. For instance in specifying for the second one shown in illustration one should specify for 63.50^m/_m which would correspond with the 2½ inches English corrugation and this, by the way, is the one which is most commonly used in the United States and the one which we find gives the greatest amount of strength and rigidity, as well as security in keeping out the water. The 3 inch English (76.20^m/_m) corruga-

tion is not very often used and the $1\frac{1}{4}$ inches English ($31.75\text{ }^m/m$) is usually used for ornamental doors and finishing work of this kind. The same with the $\frac{5}{8}$ inches English ($15.88\text{ }^m/m$).

Plate No. 47 gives the standard covering capacity in width of the sheets when laid on the roof. Some parties desire to lap the corrugations on the side two full corrugations instead of one as shown on this Plate. In this case of course the covering capacity of the sheets is reduced that much. The advantage gained is that the chance of the water beating in over the top of the end or seamed corrugation is of course much less. The sheets as carried in stock are given on this plate but intermediate lengths can always be had if time is given to cut them. When the lengths of sheets are not specified we always send sheets 8 feet net or 2.44 ^m long.

As the depth of the corrugation is likely to vary, in ordering any corrugated iron through Commission Houses customers should be very careful to inform them that the same must be furnished by Milliken Bros. in order that the corrugations of the sheets furnished may match those originally shipped.

The corrugated sheet iron is attached to the purlins by different methods. Figure 8 shows a very common way of attaching the sheet iron to the purlin, by means of what we call a clip. We do not recommend this in the least because it allows the sheet to spring and in time it may become loose. Figure 9 and Figure 10 represent other ways of executing the work, in which the clip is passed partially around the purlin, but the method recommended by us and invariably used by us is shown in Figure 11, in which the clip passes entirely around the purlin and is fastened at both ends. Figure 11, shows an angle purlin but the same principle is used no matter what shape the purlin is. The clip is a narrow band of galvanized iron and is riveted to the underside of the top of the corrugation, not to the valley or bottom of the corrugations.



FIGURE 8.



FIGURE 9.



FIGURE 10.



FIGURE 11.

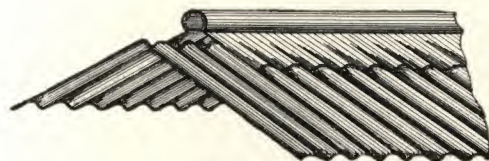


FIGURE 12.

The ridge or apex of the roof is usually covered by a ridge roll or capping piece, which closes the joint between two sheets. This is shown on Figure No. 12. This cap is made in one piece and the edges are hammered down into the corrugations to form a water tight joint. The gutters are made in a number of different shapes. Figure 13 gives dimensions of various kinds of half round gutters, the size of course depending upon the area of the roof which has to be taken care of.



FIGURE 14.

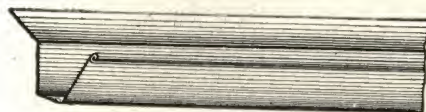


FIGURE 16.



FIGURE 17.

Figure 14 gives a general view of this form of gutter. Figure 15 shows the round gutter with the corrugated iron, the arrangement of the end of the gutter and of the leader connecting with the gutter. Figure 16 shows a more ornamental form of gutter and Figure 17 a still more ornamental one. This last named makes a very nice finish and handsome appearance at the eaves of the roof.

Figure 18 represents the flashing which is used in a variety of forms at any point where two pieces of sheet iron meet at different angles, or where corrugated iron connects with a brick wall. A piece of flashing is shown underneath a window in Figure 20. Although not shown in illustration in this catalogue, we are prepared to furnish all kinds of

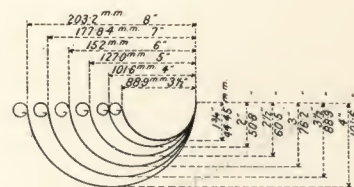


FIGURE 13.

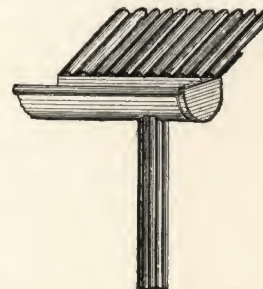


FIGURE 15.

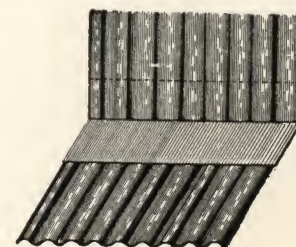


FIGURE 18.

wooden windows and doors for factory buildings. Windows as usually constructed in this country have two sashes, which are counterbalanced by weights running over a pulley, so that the lower or upper sash can be raised or lowered with little exertion. We furnish these windows complete with their sashes, frames, weights, cords, pulleys, locks and glass. The outside frames in sheet iron buildings should be covered with plain galvanized sheet iron, similar in construction to the casing as shown on Figure 19. Figure 19 shows the construction of what are called corner boards or base boards, which are wooden pieces covered with plain galvanized sheet iron to make a finish for the corrugated iron. Sashes in the monitors of buildings used for admitting light and securing ventilation are occasionally furnished with sliding sash, but we much prefer to use the form as shown in Figure 20. This sash is pivoted in the centre and is operated from the floor by means of a worm and gear. This arrangement prevents the sash from opening during a wind storm, and in closing allows the operator to bring the sash tight against the frame, so as to prevent water getting in.

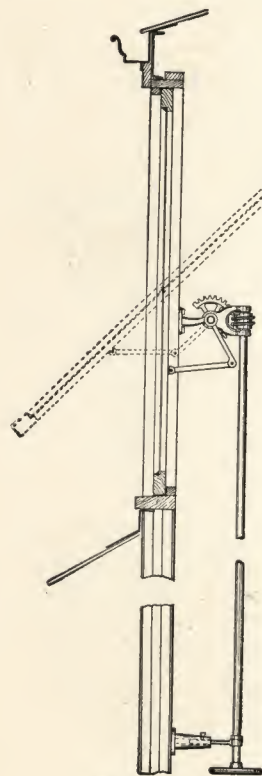


FIGURE 20.

In specifying for doors, we recommend on account of the ease of shipping, erection and the fireproof qualities, rolling steel shutter doors, which are arranged with a spring over the top and roll

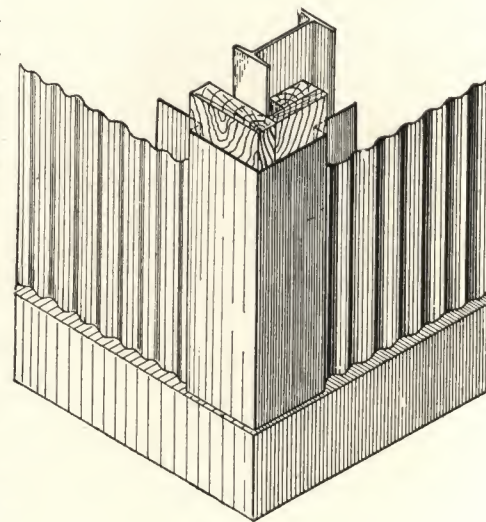


FIGURE 19.



FIGURE 21.

upwards, leaving a clear passageway for the entrance of goods as detailed on Plate 48. Figure 21 shows two of these doors. On the left hand side the door is closed and on the right hand the door is rolled up above the door opening and always completely out of the way nor is it ever subject to damage by wind.

It is absolutely necessary in sheet iron buildings, owing to the changing of the temperature of the outside air, and to prevent condensation of water on the inside surface of the sheet iron, to provide ample and sufficient ventilation. This entirely prevents condensation of moisture. In buildings having monitors it is easy to open and close the windows in the sides, but in buildings which are not provided with monitors, arrangements must be made to ventilate the same. Figure 22 shows such a

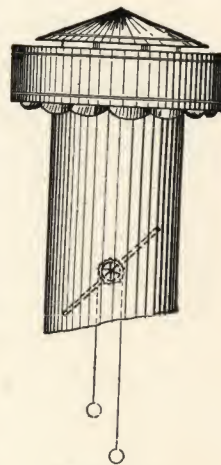


FIGURE 22.

ventilator with a damper which can be opened and closed from the floor. For the admission of light in buildings of this class we furnish several different kinds of skylights. Figure 23 shows a plain flat skylight without any apparatus. Figure 24 shows a hipped skylight

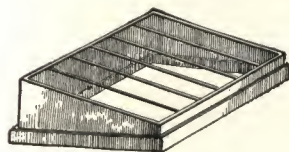


FIGURE 23.

in which the sides are composed of slat louvres and the roof is covered with glass. These slat louvres are often made very large and are provided with an apparatus to permit of their being opened and closed. These are called movable louvres. When they are not arranged to open and close they are called fixed louvres. The sides of monitors are

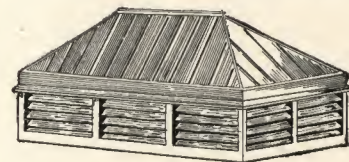


FIGURE 24.

often made with this form of construction to allow the free access of air, but of course these louvres admit

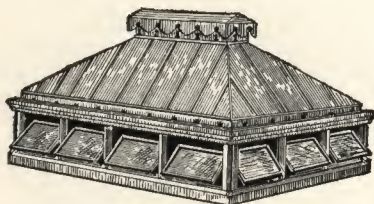


FIGURE 25.

very little if any light. Figure 25 shows a skylight with a glass roof, arrangement on the extreme top for ventilation, and the sides formed with pivoted glass sashes.

Plate No. 49 shows a special form of construction of roof particularly adapted for the manufacture of textile goods where a large amount of light is required. This also provides for the usual ventilation above the sashes, and in cases where more ventilation is required

the glass sashes are pivoted and can be operated as shown on Figure 20.

Figure 26, shows a building of the Atlas Cement Co. nearly completed and covered with corrugated galvanized sheet iron. The structural steel work during construction is shown in a photograph in another part of this catalogue. A very good idea of a sheet iron building adapted to light manufacturing work is shown in the two photographs in this catalogue entitled "Eastman Company's Building," the first one of the structural steel framework, and the second of the building as finally completed and covered with corrugated sheet iron.



FIGURE 26.

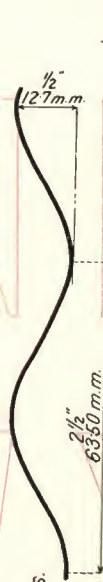
Corrugated Iron before being galvanized.

Gauge	Thickness.	Gauge.	Thickness.
Number 28 U.S.	.40 m.m.	Number 20 U.S.	.95 m.m.
" 26 "	.48 "	" 18 "	.127 "
" 24 "	.64 "	" 16 "	.159 "
" 22 "	.79 "		.0625 "

3"
76.20 m.m. Corrugations.



2 1/2"
63.50 m.m. Corrugations.



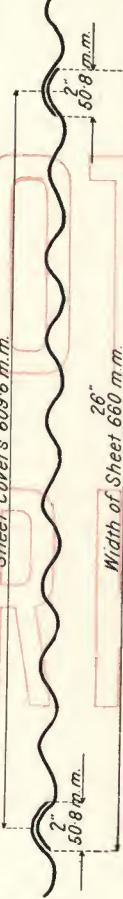
1 1/4"
31.75 m.m. Corrugations.



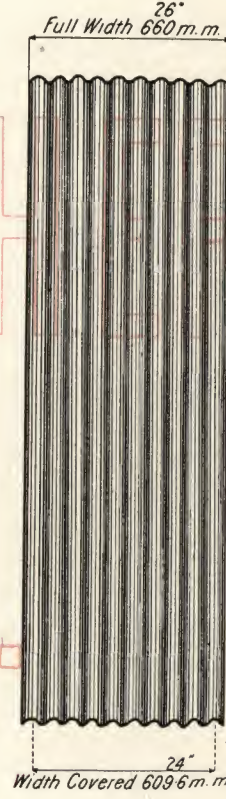
5/8"
15.88 m.m. Corrugations.



24"
Sheet Covers 609.6 m.m.

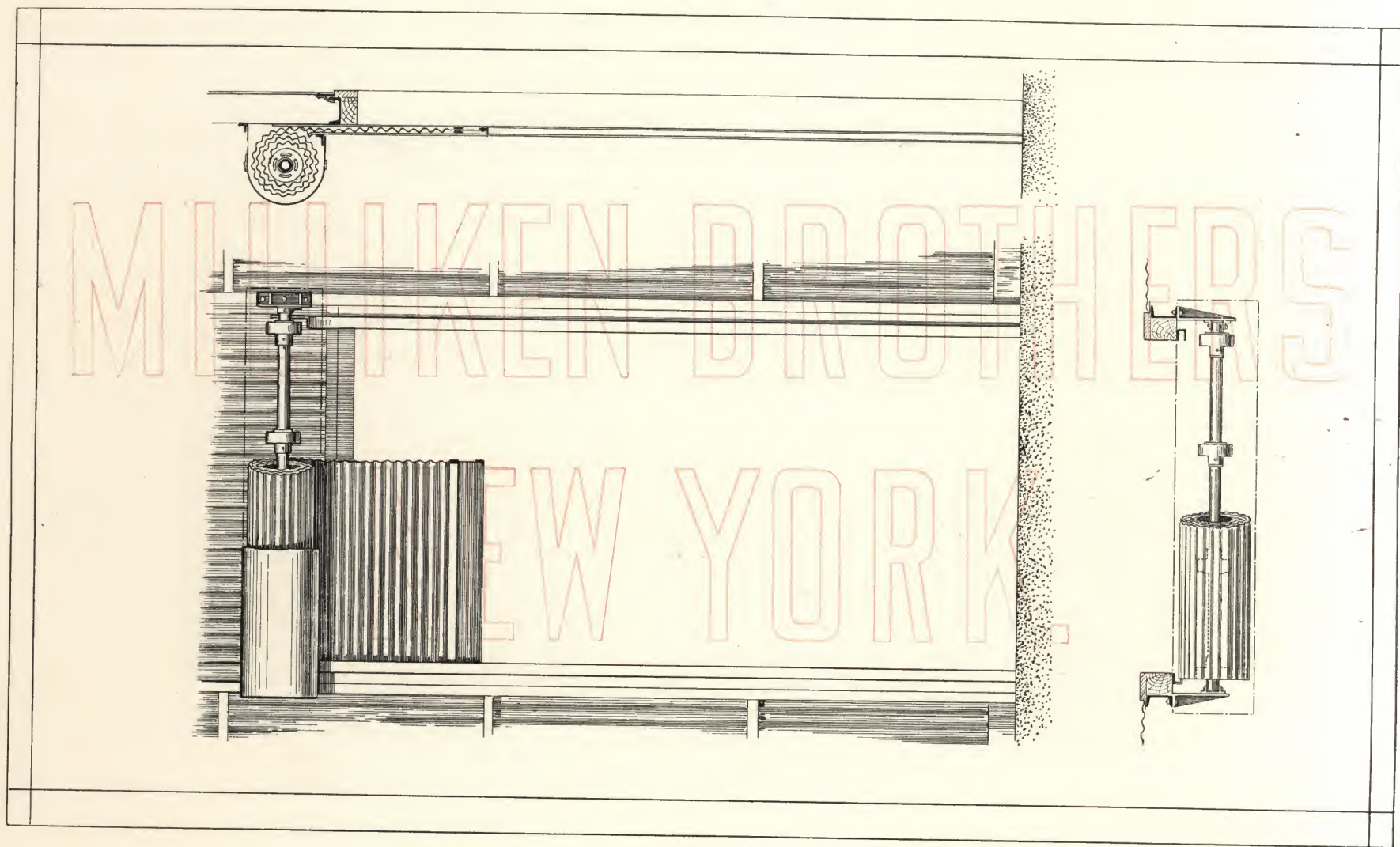


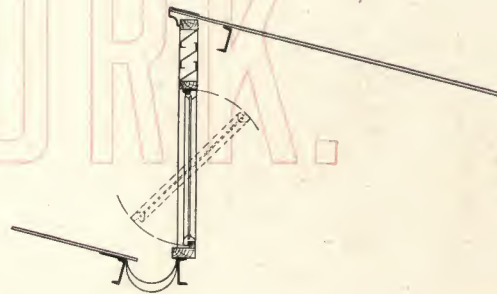
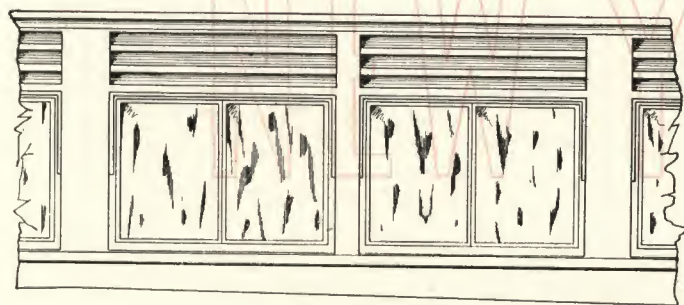
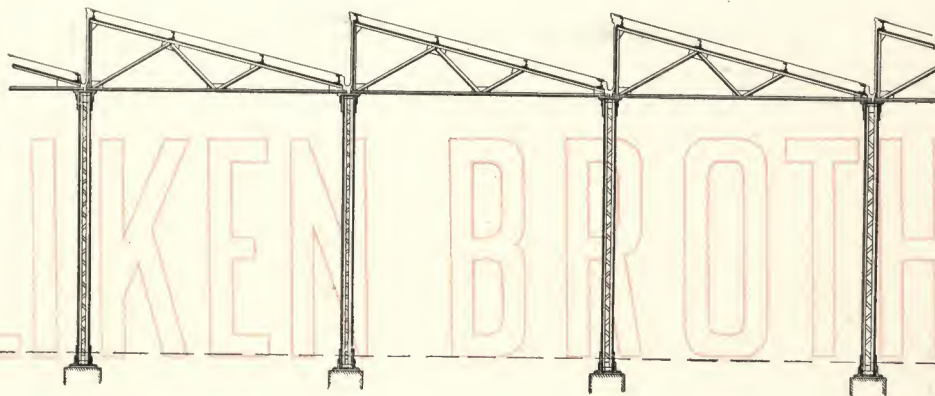
Width of Sheet 660 m.m.
Section of Sheet having 6350 m.m. Corrugations.



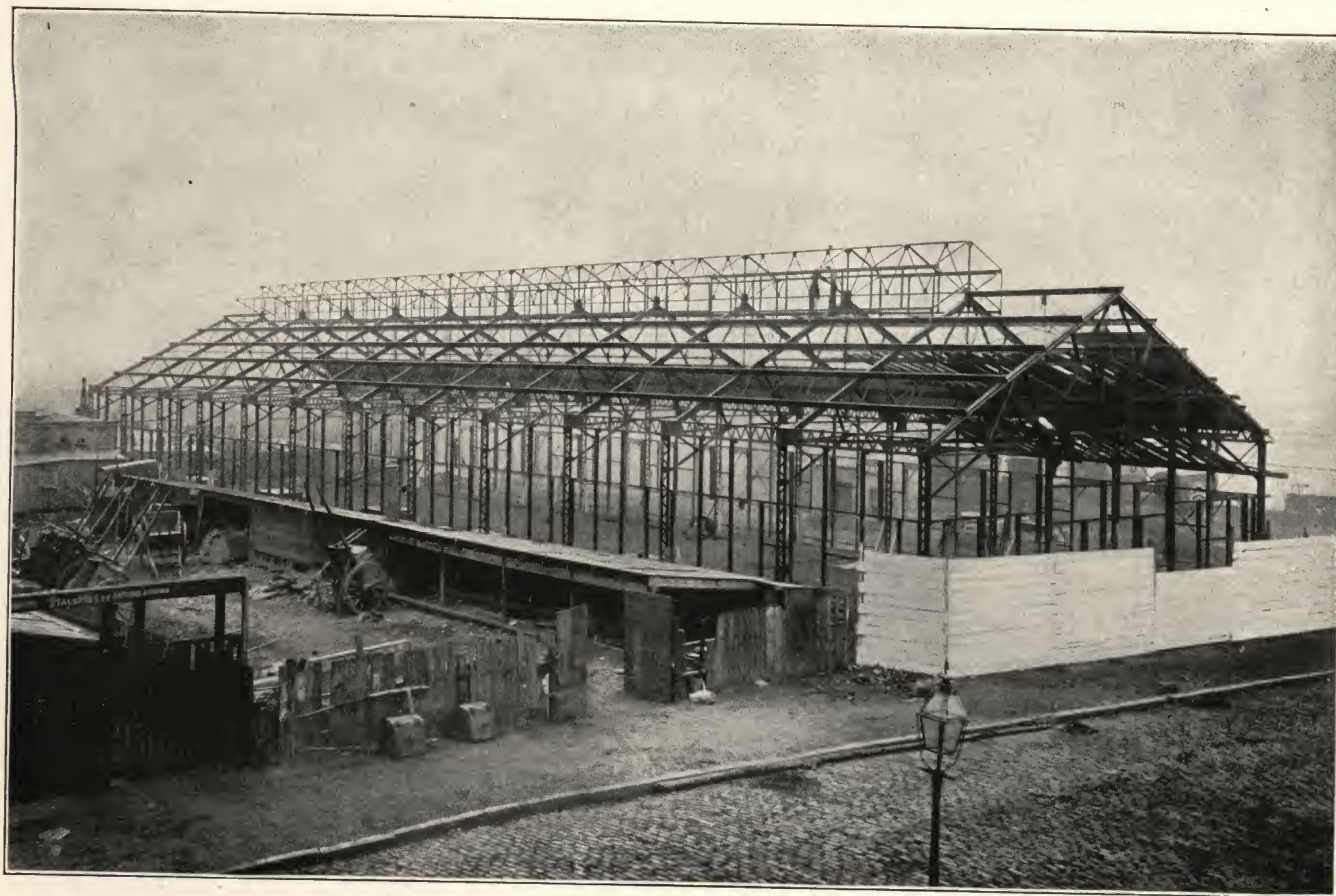
Stock Sheets, standard lengths 152 m, 183 m, 213 m, 244 m, 274 m, 304 m.
If no length is specified we send sheets 2.44 m long.
All sheets of all Gauges have uniform Width 24".
The full Width is 660 m.m. The width Covered is 609.6 m.m.

Plate No. 48.



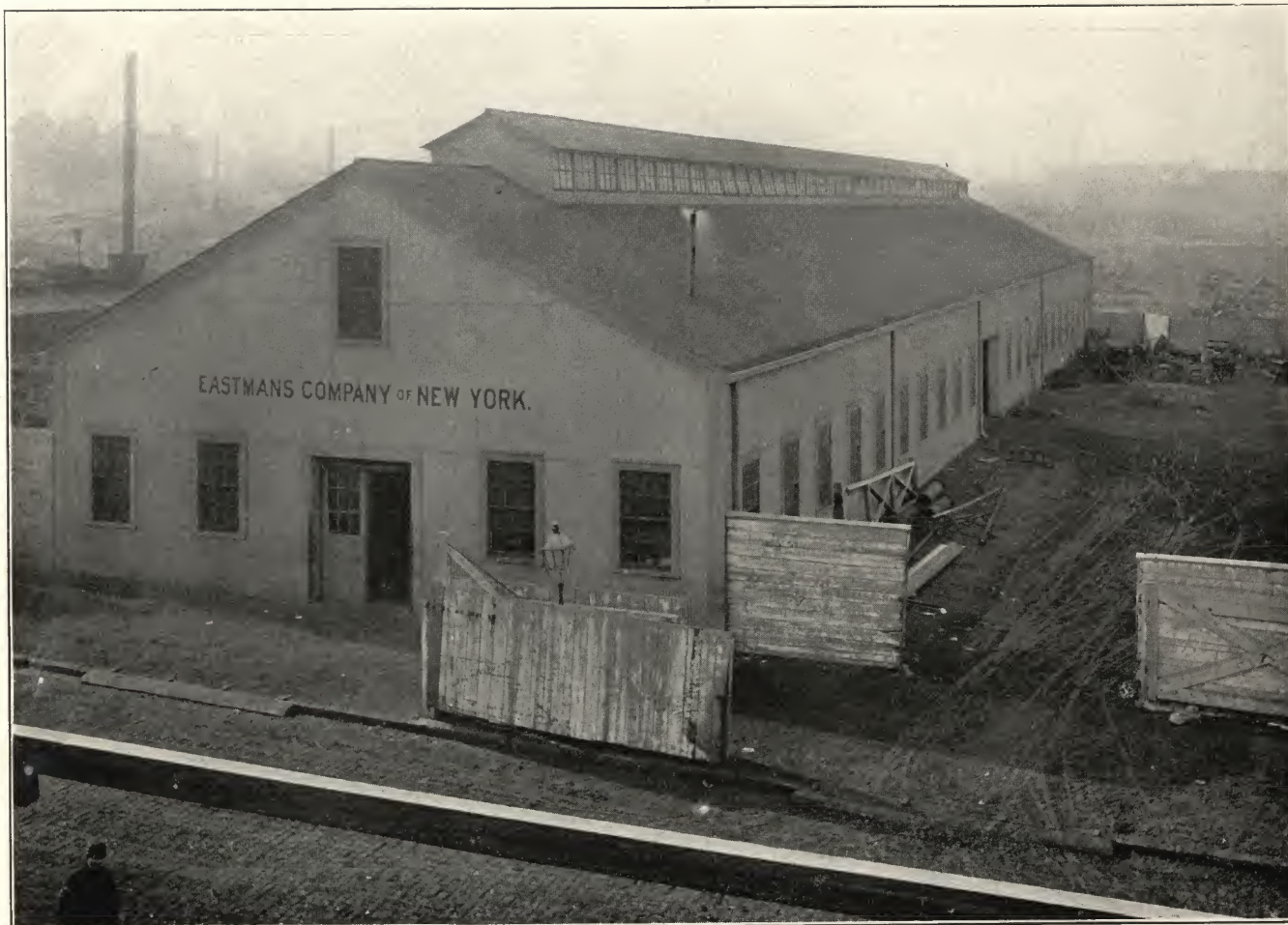


EASTMAN CO., 58TH STREET NEAR NORTH RIVER, NEW YORK CITY.



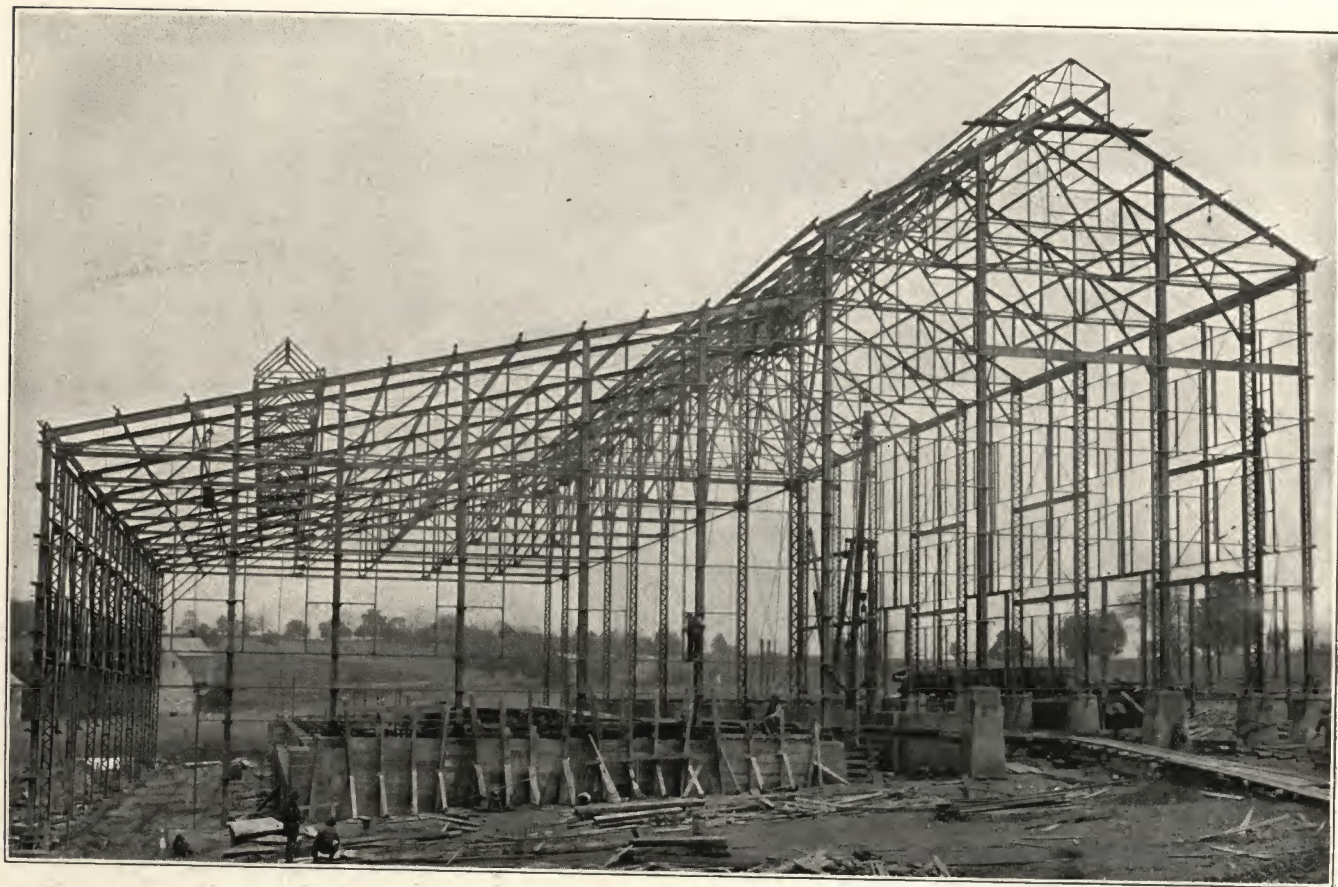
STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

EASTMAN CO., 58TH STREET NEAR NORTH RIVER, NEW YORK CITY.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

ATLAS CEMENT CO., NORTHAMPTON, PA.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

ATLAS CEMENT CO., NORTHAMPTON, PA.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

SILK MILL, SCRANTON, PA.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

SMOKE STACKS.

It has been found that, owing to the low price of steel, it is considerably cheaper to build smoke stacks of any considerable height or diameter, in steel. In addition to this they can be furnished and put up much more quickly than brick and stone chimneys can be built. There is hardly any limit to the height and diameter to which these stacks can be made and yet be self-supporting. The only requirement is that the foundations must be ample to prevent the stack being overturned in a wind storm. These stacks are usually constructed as shown on plate No. 50.

In order to gain access to the top, a ladder is supplied up the side. An ornamental top is also furnished to give a pleasing appearance. The bottom of the stack is securely held in place by long bolts and beams buried in the foundation. Opening is made in the mason work below the stack for the boiler flue connection, and also doors to clean out the soot and ashes which ordinarily accumulate at the bottom of a large stack.

At a point near the top we usually furnish a band on which a trolley is fastened, so that when the stack needs painting all that is necessary is to arrange a block and fall on this trolley and a man can be pulled up and down the stack, and by means of the trolley can push himself around to any point that he may desire to reach for painting purposes. This is clearly shown in illustration on page 170.

Where the bottom of the stack is a considerable distance from the boilers, it is not necessary to line the stack, as the products of combustion are sufficiently cooled to obviate corrosion; but in cases where the boilers

are near to the base of the stack it is advisable to line the stack, in some cases with fire brick and in some cases with common brick, for at least two-thirds of the distance up the stack; but we recommend a cheaper, and what we consider a better, form of construction, that is, our patent slab construction which has already been referred to in the previous part of this catalogue. This lining has the advantage over brick in that it takes up less room; consequently the diameter of the steel stack can be less, and further, it is not porous like ordinary brick, hence the gases of combustion do not get at the steel shell.

For the convenience of our customers we give on Table No. 38 the diameter and height of stacks corresponding to the nominal English horse power for boilers; also the effective area and the actual area of stacks of different diameters, and on Table No. 39 we give the equivalent French horse power to English horse power, so that the Table No. 38 may be used for the English or the metric system.

We are also prepared to furnish stacks which are not self-supporting; in other words, guyed stacks. Illustration of four of these stacks is shown on page 170.

We are also prepared to furnish very ornamental stacks. An example of this is shown in the photograph on page 169, where a circular stair is used to gain access to the balcony or platform on top, which has a very ornamental railing. The extreme top of the stack is also supplied with an ornamental railing. This class of work is usually furnished for cities where the stack is intended to be in keeping with the building.

Plate No. 50.

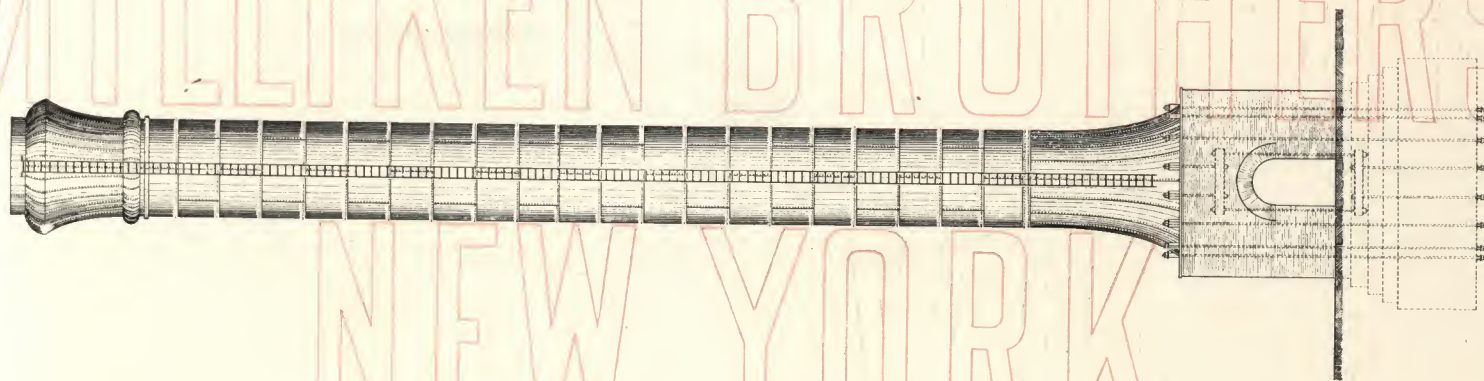


Table No. 38.

Dimensions of Chimney Stacks for Boilers of different Horse Power (English).

Inside Diam. in inches.		Inside Diam. in metres.		Height of Chimney Stack in metres and feet.														Effective Area.		Actual Area.			
				50ft. 15.2397m.	60ft. 18.2876m.	70ft. 21.3356m.	80ft. 24.3835m.	90ft. 27.4315m.	100ft. 30.479m.	110ft. 33.527m.	125ft. 38.099m.	150ft. 45.719m.	175ft. 53.339m.	200ft. 60.958m.	225ft. 68.579m.	250ft. 76.198m.	275ft. 83.818m.					300ft. 91.438m.	
Commercial Horse Power (English).																				Sq. feet.	Sq. metres.	Sq. feet.	Sq. metres.
18	0.4572	23	25	27													0.97	0.901	1.77	1.644			
21	0.5334	35	38	41													1.47	1.365	2.41	2.238			
24	0.6095	49	54	58	62												2.08	1.932	3.14	2.917			
27	0.6857	65	72	78	83												2.78	2.582	3.98	3.697			
30	0.7619	84	92	100	107	113											3.58	3.325	4.91	4.561			
33	0.8381		115	125	133	141											4.47	4.152	5.94	5.518			
36	0.9143		141	152	163	173	182										5.47	5.081	7.07	6.568			
39	0.9905			183	196	206	219										6.57	6.103	8.30	7.740			
42	1.0667			216	231	245	258	271									7.76	7.209	9.62	8.937			
48	1.2191				311	330	348	365	389								10.44	9.698	12.57	1.167			
54	1.3715				402	427	449	472	503	551							13.51	1.255	15.90	1.477			
60	1.5239				505	539	565	593	632	692	748						16.98	1.577	19.64	1.824			
66	1.6763					658	694	728	776	849	918	981					20.83	1.935	23.76	2.207			
72	1.8287					792	835	876	934	1023	1105	1181					25.08	2.329	28.27	2.626			
78	1.9811						995	1038	1107	1212	1310	1400					29.73	2.761	33.18	3.082			
84	2.1335						1163	1214	1294	1418	1531	1637					34.76	3.228	38.48	3.574			
90	2.2859						1344	1415	1496	1639	1770	1893					40.19	3.733	44.18	4.104			
96	2.4383						1532	1616	1720	1876	2027	2167					46.01	4.274	50.27	4.670			
102	2.5907						1739	1823	1944	2129	2300	2459					52.21	4.851	56.74	5.271			
108	2.7431						1959	2054	2190	2399	2591	2770					58.82	5.465	63.61	5.909			
114	2.8955						2192	2289	2451	2685	2900	3100					65.83	6.116	70.88	6.585			
120	3.0479						2438	2557	2725	2986	3225	3448	3657				73.11	6.802	78.54	7.295			
126	3.2003						2697	2829	3015	3303	3568	3814	4046				81	7.526	86.59	8.044			
132	3.3527						2969	3114	3320	3637	3928	4199	4454				89.17	8.285	95.03	8.828			
138	3.5051						3255	3413	3639	3986	4306	4603	4882				97.64	9.081	103.86	9.648			
144	3.6575						3553	3727	3973	4352	4701	5025	5330	5618			106.7	9.914	113.09	10.506			
150	3.8099						3865	4053	4321	4733	5113	5466	5797	6110			116.06	10.783	122.71	11.393			
156	3.9623						4189	4394	4684	5131	5542	5925	6284	6624	6946		126.80	11.688	132.73	12.330			
162	4.1147						4527	4748	5061	5544	5988	6402	6790	7157	7505		135.9	12.629	143.13	13.296			
168	4.2671						4879	5117	5454	5975	6454	6900	7318	7713	8089	8450	146.51	13.611	153.93	14.302			
174	4.4195						5242	5497	5860	6420	6934	7413	7863	8287	8691	9079	157.40	14.624	165.13	15.340			
180	4.5719						5619	5893	6282	6881	7433	7946	8428	8883	9317	9732	168.72	15.675	176.71	16.416			

Table No. 39.

Table of English Horse Power equivalent to French Horse Power.

French Horse Power.	0	1	2	3	4	5	6	7	8	9
0		986337	197267	295901	394535	493168	591802	690436	789069	887703
10	986337	108497	118360	128224	138087	147951	157814	167677	177541	187404
20	197267	207131	216994	226857	236721	246584	256448	266311	276174	286038
30	295901	305764	315628	325491	335354	345218	355081	364945	374808	384671
40	394535	404398	414261	424125	433988	443852	453715	463578	473442	483305
50	493168	503032	512895	522758	532622	542485	552349	562212	572075	581938
60	591802	601665	611529	621392	631255	641119	650982	660845	670709	680572
70	690436	700299	710162	720026	729889	739753	749616	759479	769343	779206
80	789069	798933	808796	818659	828523	838386	848250	858113	867976	877840
90	887703	897566	907430	917293	927156	937020	946883	956747	966610	976473

Table of French Horse Power equivalent in English Horse Power.

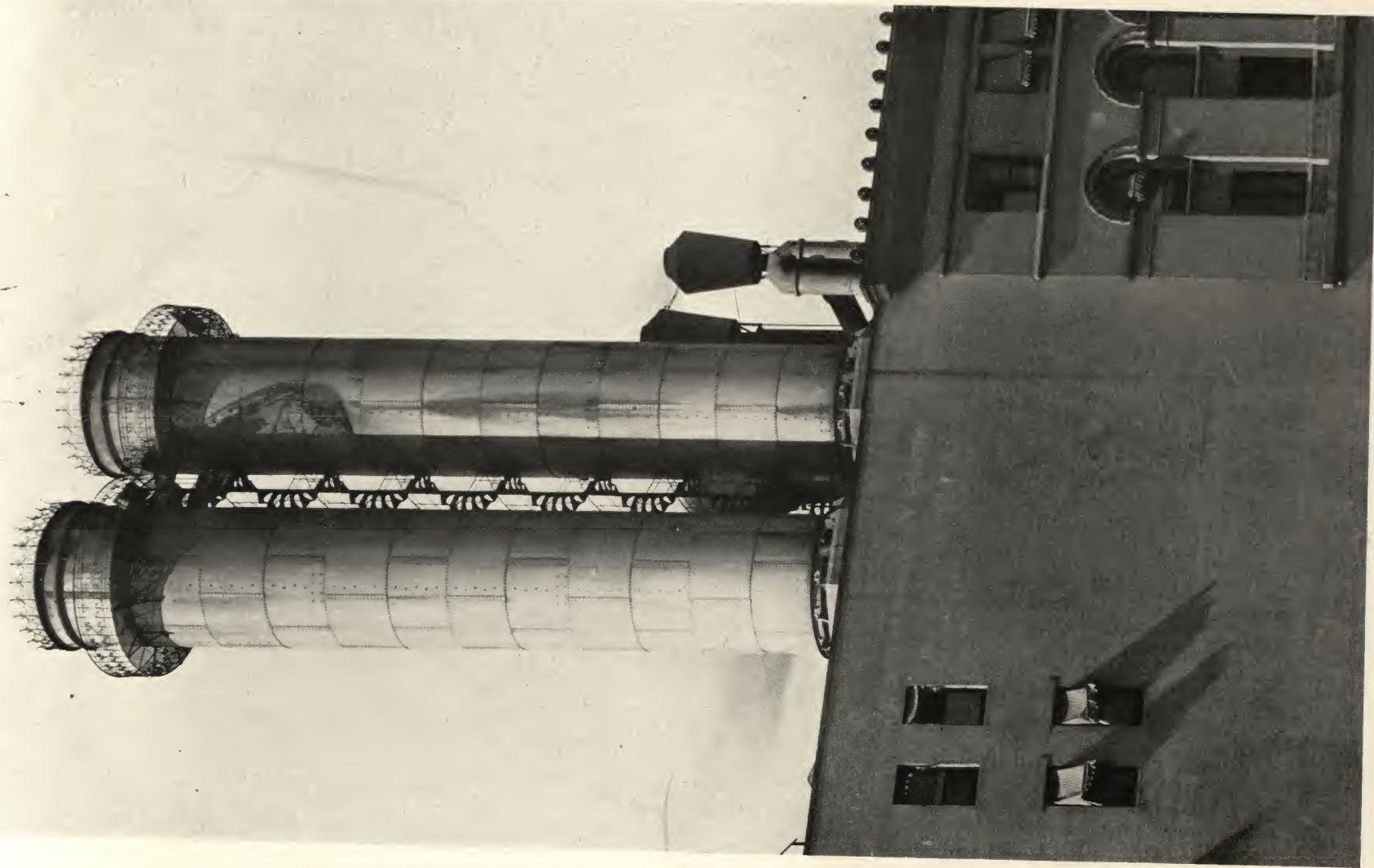
English Horse Power.	0	1	2	3	4	5	6	7	8	9
0		101385	202770	304156	405540	506925	608310	709695	811080	912465
10	101385	111524	121662	131801	141939	152078	162216	172355	182493	192632
20	202770	212909	223047	233186	243324	253463	263601	273740	283878	294017
30	304155	314294	324432	334571	344709	354848	364986	375125	385263	395402
40	405540	415679	425817	435956	446094	456233	466371	476509	486648	496787
50	506925	517064	527202	537341	547479	557618	567756	577895	588033	598172
60	608310	618449	628587	638726	648864	659003	669141	679280	689418	699557
70	709695	719834	729972	740111	750249	760388	770526	780665	790803	800942
80	811080	821219	831357	841496	851634	861773	871911	882050	892188	902327
90	912465	922604	932742	942881	953019	963158	973296	983435	993573	100371

OAHU SUGAR CO., HONOLULU, H. I.



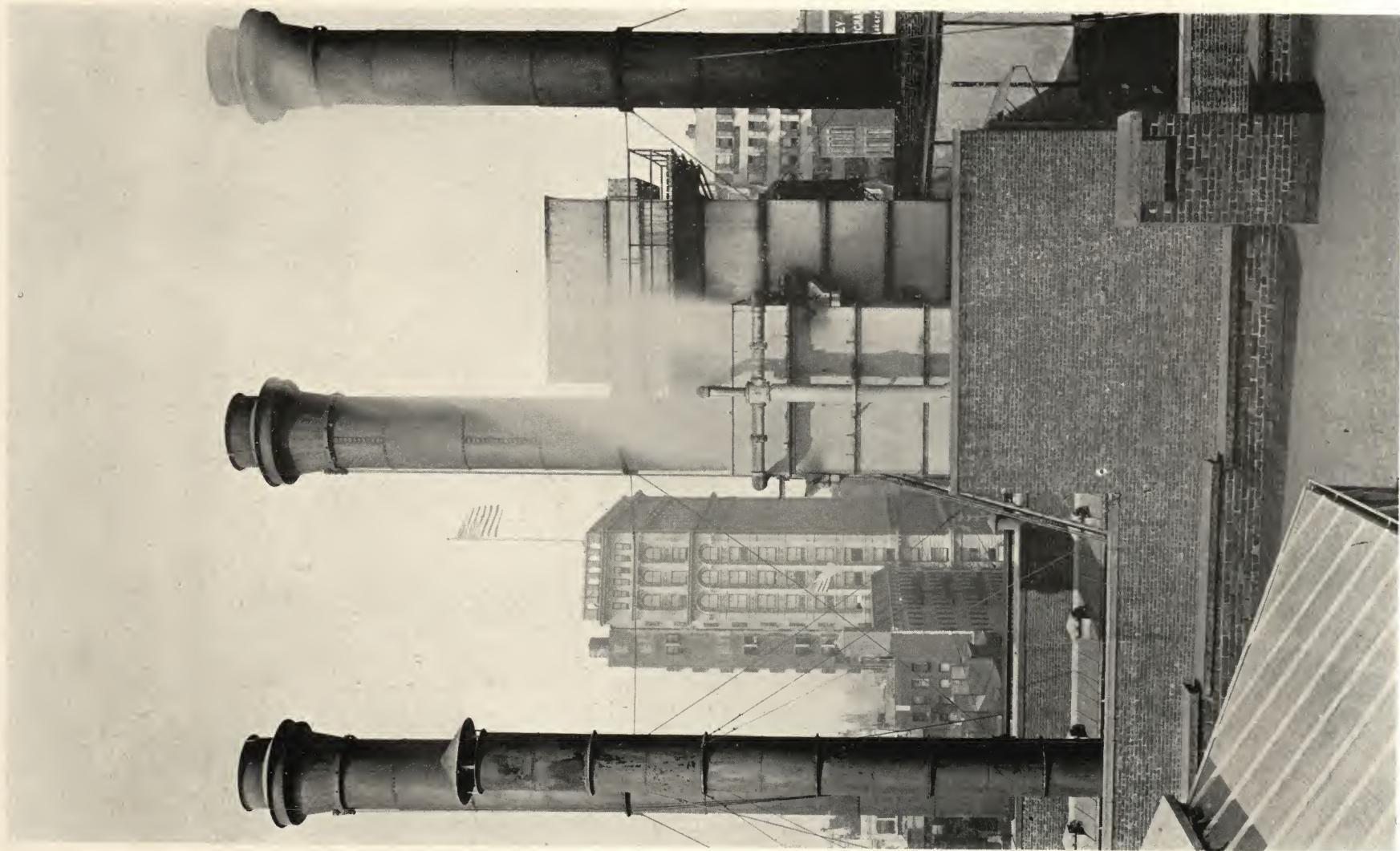
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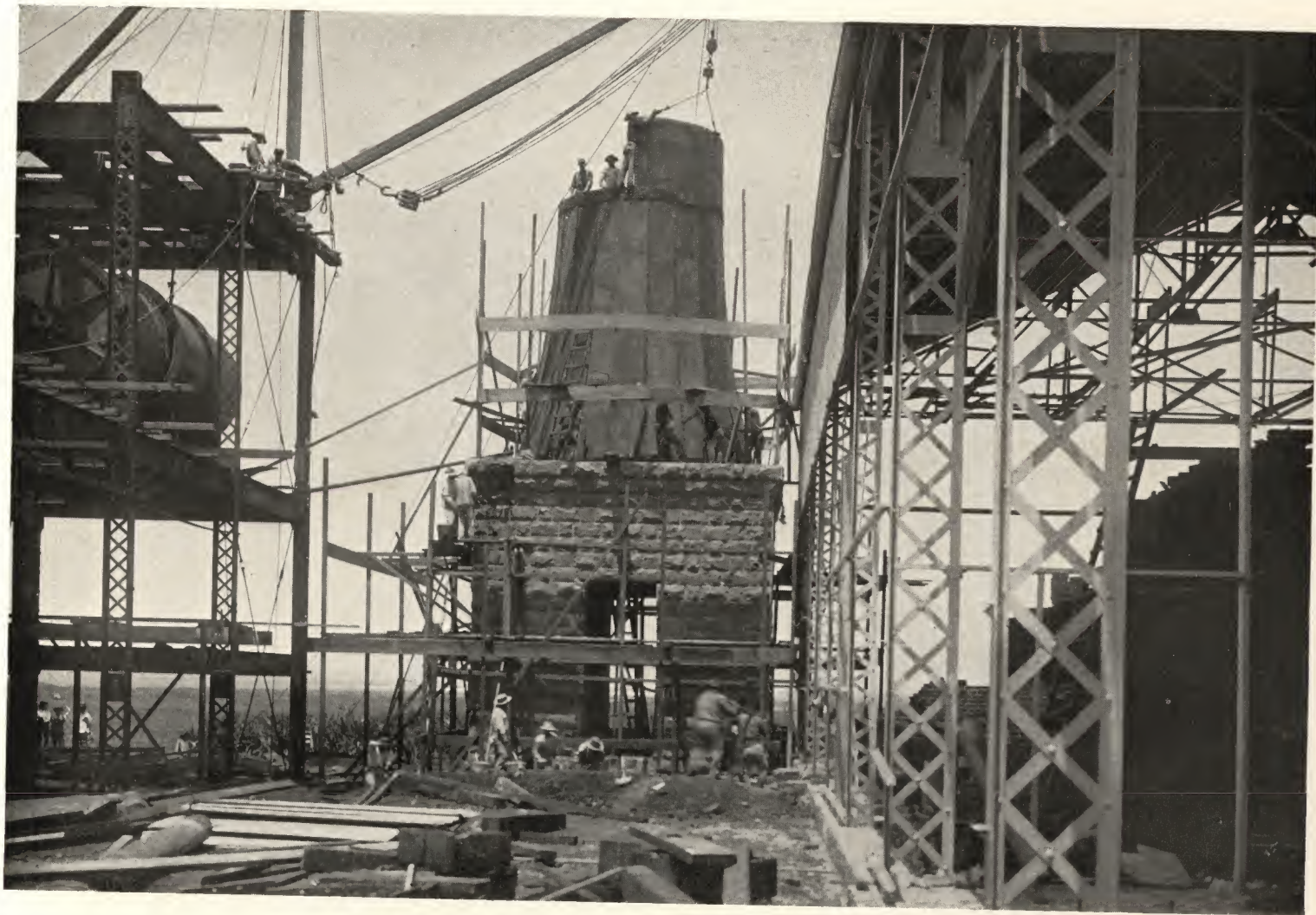
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WAIALUA SUGAR MILL, HAWAIIAN ISLANDS.



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TANKS.

In nearly every manufacturing business, for one thing or another, tanks are used for the storage of water or liquids of some kind, and they are often used for the reception and storage of rock, coal, or other classes of raw material used for manufacturing purposes. Tanks are usually round or square, as shown on Plate No. 51. In some cases the bottoms are flat, supported on wooden floors or often on steel beams. In other cases the bottoms of the tank are hopper or cone shaped in order that all of the material can be discharged from the tank and be discharged from one given point. At this point a valve is often introduced and sometimes an automatic weighing machine to carefully weigh the material that passes through the opening.

A large number of hopper shaped tanks are shown in the photograph on page 175. Platforms and stands are often required to elevate the tanks. These are fully illustrated and explained in other parts of this catalogue.

In electric light stations and large steam generating plants it is often required to store large quantities of coal. These coal bins or tanks are usually situated in the upper part of the building and the coal is discharged directly by gravity to the boilers. These bins are built of different shapes, usually with a hopper or cone shaped bottom, and their design depends largely on the size and character of the building where they are intended to go and also the number of boilers for which they are intended to supply coal. This class of work calls for special design.

We give in Tables Nos. 40 and 41 the capacity of round and square tanks in gallons and litres. This will be found very convenient for instantly getting at the capacity of any size tank of any ordinary depth.

Plate No. 51.

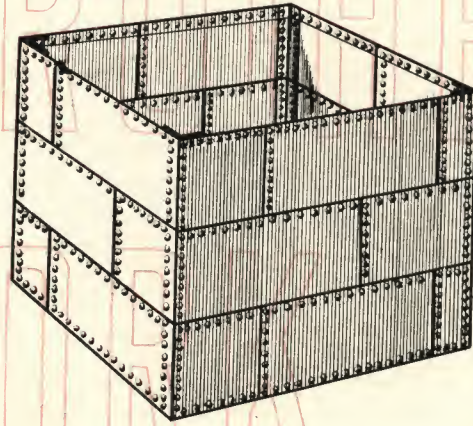
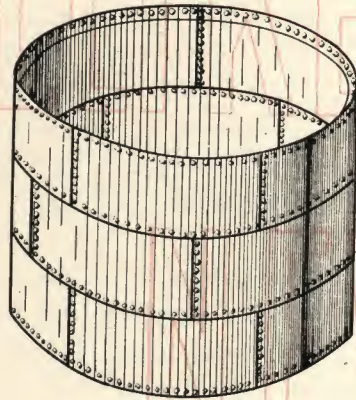


Table No. 40.

Capacity of Round Tanks in Gallons and Litres

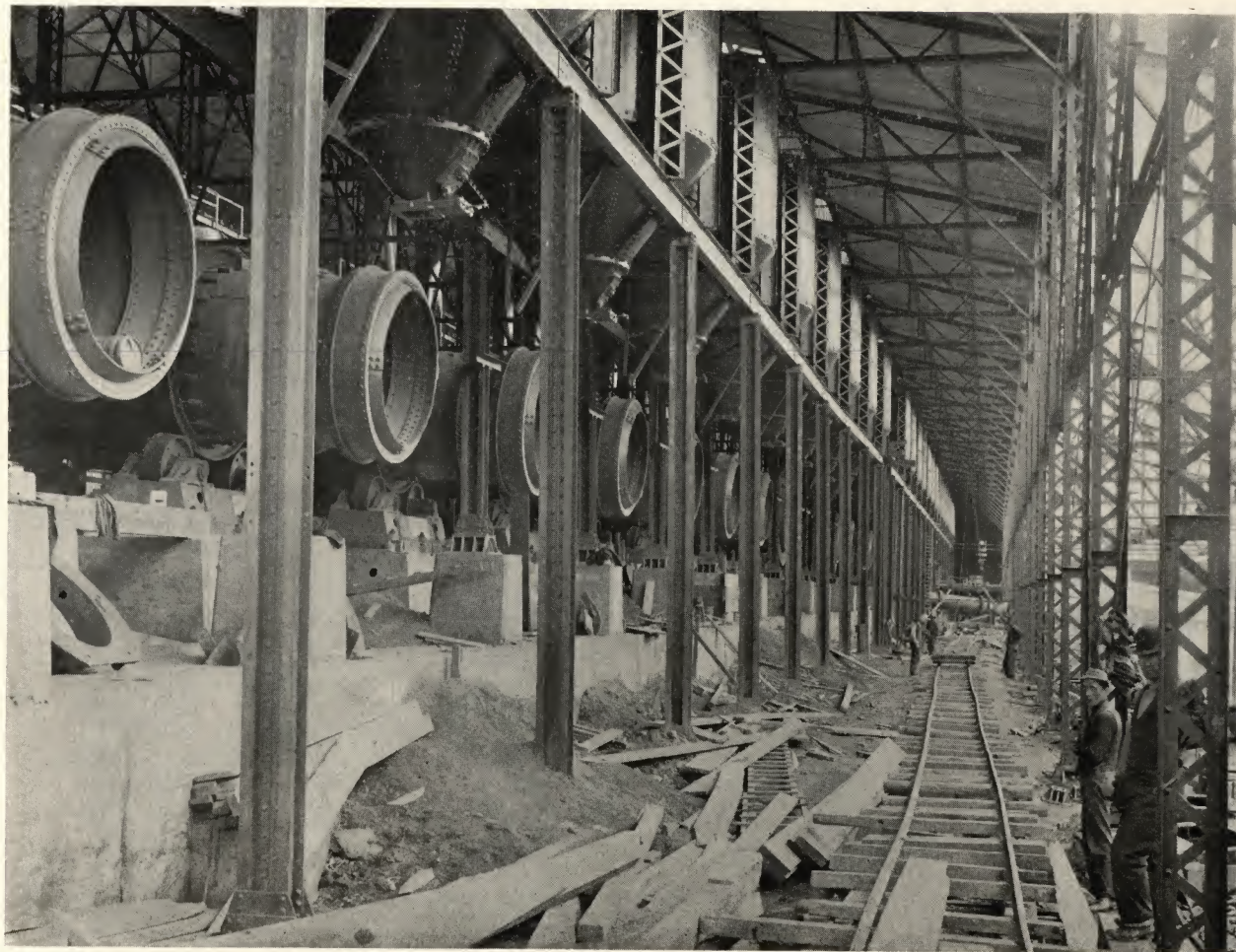
Capacity		Inside Diameter			Inside Depth			Capacity		Inside Diameter			Inside Depth			Capacity		Inside Diameter			Inside Depth		
Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres	Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres	Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres
158	598	3	0	.914	3	0	.914	4945	18718	10	0	3.048	8	5	2.565	14702	55650	15	6	4.724	10	6	3.200
321	1215	4	0	1.219	3	5	1.041	1943	7355	10	6	3.200	3	0	.914	17526	66339	15	6	4.724	12	6	3.810
587	2223	5	0	1.524	4	0	1.219	2590	9804	10	6	3.200	4	0	1.219	20349	77025	15	6	4.724	14	6	4.420
632	2392	6	0	1.829	3	0	.914	4155	15730	10	6	3.200	6	5	1.956	15667	59303	16	0	4.877	10	6	3.200
845	3198	6	0	1.829	4	0	1.219	6100	23090	10	6	3.200	9	5	2.870	18675	70689	16	0	4.877	12	6	3.810
1145	4334	6	0	1.829	5	5	1.651	2132	8070	11	0	3.353	3	0	.914	21683	82074	16	0	4.877	14	6	4.420
741	2805	6	6	1.981	3	0	.914	2843	10761	11	0	3.353	4	0	1.219	16660	63061	16	6	5.029	10	6	3.200
993	3759	6	6	1.981	4	0	1.219	4561	17264	11	0	3.353	6	5	1.956	19864	75181	16	6	5.029	12	6	3.810
863	3267	7	0	2.134	3	0	.914	7405	28029	11	0	3.353	10	6	3.200	23064	87304	16	6	5.029	14	6	4.420
1151	4357	7	0	2.134	4	0	1.219	2331	8823	11	6	3.505	3	0	.914	17827	67480	17	0	5.182	10	6	3.200
1847	6991	7	0	2.134	6	5	1.956	3107	11761	11	6	3.505	4	0	1.219	21233	80373	17	0	5.182	12	6	3.810
990	3747	7	6	2.286	3	0	.914	4985	18869	11	6	3.505	6	5	1.956	24619	93190	17	0	5.182	14	6	4.420
1322	5004	7	6	2.286	4	0	1.219	8093	30634	11	6	3.505	10	6	3.200	27733	104975	17	0	5.182	16	6	5.029
2120	8025	7	6	2.286	6	5	1.956	2538	9607	12	0	3.658	3	0	.914	18892	71512	17	6	5.334	10	6	3.200
1127	4266	8	0	2.438	3	0	.914	3384	12809	12	0	3.658	4	0	1.219	22490	85131	17	6	5.334	12	6	3.810
1500	5678	8	0	2.438	4	0	1.219	5428	20546	12	0	3.658	6	5	1.956	26088	98751	17	6	5.334	14	6	4.420
2031	7688	8	0	2.438	5	5	1.651	8802	33317	12	0	3.658	10	6	3.200	29387	111235	17	6	5.334	16	6	5.029
2781	10527	8	0	2.438	7	5	2.261	2754	10424	12	6	3.810	3	0	.914	19827	75051	18	0	5.486	10	6	3.200
1273	4819	8	6	2.591	3	0	.914	3672	13899	12	6	3.810	4	0	1.219	23475	88860	18	0	5.486	12	6	3.810
1697	6423	8	6	2.591	4	0	1.219	5890	22295	12	6	3.810	6	5	1.956	27281	103264	18	0	5.486	14	6	4.420
2299	8702	8	6	2.591	5	5	1.651	9638	36482	12	6	3.810	10	6	3.200	31087	117669	18	0	5.486	16	6	5.029
3148	11916	8	6	2.591	7	5	2.261	6370	24112	13	0	3.962	6	5	1.956	20944	79279	18	6	5.639	10	6	3.200
1425	5394	9	0	2.743	3	0	.914	10420	39442	13	0	3.962	10	6	3.200	24796	93860	18	6	5.639	12	6	3.810
1900	7192	9	0	2.743	4	0	1.219	6870	26004	13	6	4.115	6	5	1.956	32836	124295	18	6	5.639	16	6	5.029
3053	11557	9	0	2.743	6	5	1.956	11150	42205	13	6	4.115	10	6	3.200	22093	83628	19	0	5.791	10	6	3.200
4004	15157	9	0	2.743	8	5	2.565	7388	27965	14	0	4.267	6	5	1.956	30399	115070	19	0	5.791	14	6	4.420
1590	6018	9	6	2.896	3	0	.914	11995	45403	14	0	4.267	10	6	3.200	38883	147182	19	0	5.791	18	6	5.639
2120	8025	9	6	2.896	4	0	1.219	14298	54121	14	0	4.267	12	6	3.810	23271	88088	19	6	5.944	10	6	3.200
3402	12873	9	6	2.896	6	5	1.956	12866	48700	14	6	4.420	10	6	3.200	32018	121198	19	6	5.944	14	6	4.420
4992	18896	9	6	2.896	9	5	2.870	15326	58012	14	6	4.420	12	6	3.810	40954	155031	19	6	5.944	18	6	5.639
1762	6670	10	0	3.048	3	0	.914	13778	52152	15	0	4.572	10	6	3.200	24480	92664	20	0	6.096	10	6	3.200
2348	8888	10	0	3.048	4	0	1.219	16413	62126	15	0	4.572	12	6	3.810	33684	127509	20	0	6.096	14	6	4.420
3770	14270	10	0	3.048	6	5	1.956	19057	72134	15	0	4.572	14	6	4.420	43085	163102	20	0	6.096	18	6	5.639

Table No. 41.

Capacity of Square Tanks in Gallons and Litres.

Capacity		Side of Square			Inside Depth			Capacity		Side of Square			Inside Depth			Capacity		Side of Square			Inside Depth		
Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres	Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres	Gallons	Litres	Ft.	In.	Metres	Ft.	In.	Metres
202	765	3	0	.914	3	0	.914	6358	24068	10	0	3.048	8	6	2.591	18870	71428	15	6	4.724	10	6	3.200
419	1586	4	0	1.219	3	6	1.067	2474	9365	10	6	3.200	3	0	.914	22463	85028	15	6	4.724	12	6	3.810
748	2831	5	0	1.524	4	0	1.219	3299	12486	10	6	3.200	4	0	1.219	26057	98634	15	6	4.724	14	6	4.420
808	3058	6	0	1.829	3	0	.914	5360	20289	10	6	3.200	6	6	1.981	20106	76104	16	0	4.877	10	6	3.200
1077	4077	6	0	1.829	4	0	1.219	7834	29654	10	6	3.200	9	6	2.896	23936	90605	16	0	4.877	12	6	3.810
1481	5606	6	0	1.829	5	6	1.676	2715	10277	11	0	3.353	3	0	.914	27766	105100	16	0	4.877	14	6	4.420
348	3588	6	6	1.981	3	0	.914	3620	13703	11	0	3.353	4	0	1.219	21383	80941	16	6	5.029	10	6	3.200
1264	4785	6	6	1.981	4	0	1.219	5883	22268	11	0	3.353	6	6	1.981	25455	96352	16	6	5.029	12	6	3.810
1100	4164	7	0	2.134	3	0	.914	9503	35969	11	0	3.353	10	6	3.200	29528	111770	16	6	5.029	14	6	4.420
1466	5549	7	0	2.134	4	0	1.219	2968	11234	11	6	3.505	3	0	.914	22698	85918	17	0	5.182	10	6	3.200
2382	9017	7	0	2.134	6	6	1.981	3957	14761	11	6	3.505	4	0	1.219	27022	102283	17	0	5.182	12	6	3.810
1262	4777	7	6	2.286	3	0	.914	6430	24340	11	6	3.505	6	6	1.981	31345	118646	17	0	5.182	14	6	4.420
1683	6371	7	6	2.286	4	0	1.219	10387	39318	11	6	3.505	10	6	3.200	35668	135028	17	0	5.182	16	6	5.029
2735	10352	7	6	2.286	6	6	1.981	3231	12230	12	0	3.658	3	0	.914	24053	91048	17	6	5.334	10	6	3.200
1436	5436	8	0	2.438	3	0	.914	4308	16308	12	0	3.658	4	0	1.219	28634	108390	17	6	5.334	12	6	3.810
1915	7249	8	0	2.438	4	0	1.219	7001	26501	12	0	3.658	6	6	1.981	33216	125730	17	6	5.334	14	6	4.420
2633	9967	8	0	2.438	5	6	1.676	11309	42808	12	0	3.658	10	6	3.200	37797	143068	17	6	5.334	16	6	5.029
3590	13589	8	0	2.438	7	6	2.286	3506	13269	12	6	3.810	3	0	.914	25447	96321	18	0	5.486	10	6	3.200
1621	6136	8	6	2.591	3	0	.914	4675	17697	12	6	3.810	4	0	1.219	30294	114668	18	0	5.486	12	6	3.810
2162	8184	8	6	2.591	4	0	1.219	7597	28756	12	6	3.810	6	6	1.981	35141	133015	18	0	5.486	14	6	4.420
2972	11250	8	6	2.591	5	6	1.676	12272	46453	12	6	3.810	10	6	3.200	39988	151361	18	0	5.486	16	6	5.029
4053	15343	8	6	2.591	7	6	2.286	8217	31103	13	0	3.962	6	6	1.981	26880	101749	18	6	5.639	10	6	3.200
1818	6855	9	0	2.743	3	0	.914	13273	50242	13	0	3.962	10	6	3.200	32000	121130	18	6	5.639	12	6	3.810
2424	9176	9	0	2.743	4	0	1.219	8861	33541	13	6	4.115	6	6	1.981	42240	159886	18	6	5.639	16	6	5.029
3938	14907	9	0	2.743	6	6	1.981	14314	54182	13	6	4.115	10	6	3.200	28353	107326	19	0	5.791	10	6	3.200
5150	19493	9	0	2.743	8	6	2.591	9530	36076	14	0	4.267	6	6	1.981	39154	148213	19	0	5.791	14	6	4.420
2025	7666	9	6	2.896	3	0	.914	15394	58270	14	0	4.267	10	6	3.200	49955	189088	19	0	5.791	18	6	5.639
2700	10220	9	6	2.896	4	0	1.219	18326	69369	14	0	4.267	12	6	3.810	29865	113044	19	6	5.994	10	6	3.200
4388	16611	9	6	2.896	6	6	1.981	16513	62509	14	6	4.420	10	6	3.200	41242	156108	19	6	5.994	14	6	4.420
6413	24275	9	6	2.896	9	6	2.896	19658	74408	14	6	4.420	12	6	3.810	52619	200308	19	6	5.994	18	6	5.639
2244	8495	10	0	3.048	3	0	.914	17672	66893	15	0	4.572	10	6	3.200	31416	119216	20	0	6.096	10	6	3.200
2992	11327	10	0	3.048	4	0	1.219	21038	79635	15	0	4.572	12	6	3.810	43384	164217	20	0	6.096	14	6	4.420
4862	18405	10	0	3.048	6	6	1.981	24404	92376	15	0	4.572	14	6	4.420	56352	209513	20	0	6.096	18	6	5.639

ATLAS CEMENT WORKS, NORTHAMPTON, PA.



STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.



ATLAS CEMENT WORKS, NORTHAMPTON, PA.



STEEL WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

KIOSKS, OR PUBLIC MUSIC STANDS.

In nearly all Southern countries, and in fact, in a great many of the Northern countries, it is customary to have located in the centre of the principal parks, Kiosks, or Public Music Stands, where bands play at certain times. It is almost impossible to give any details relative to this class of work as it depends entirely on the size of the stand, which is largely governed by the number of men in the orchestra or band, and the detailing of the work depends entirely upon the amount of ornamentation required.

Page 178 shows a photograph of one that is rather simple and plain in design. Page 179 shows one somewhat more ornamental, and page 180 still more ornamental. When the stands are as ornamental as shown on page 180 it is desirable to have the parts which are exposed to the weather electro-bronzed, which will prevent their rusting.

Special designs will be submitted on application showing any desired amount of ornamentation.







CRANES AND DERRICKS.

On Plate No. 52 we show a very useful and inexpensive crane for the unloading of merchandise from cars or wagons, by means of a portable hoisting engine. This apparatus is so constructed that it can be easily changed from place to place, and is a handy article in storage yards, railroad stations, sugar plantations, etc.

Plate No. 53 shows a traveling crane which has not only the transverse movement of the trolley, but the entire crane moves longitudinally on an elevated steel track. A picture of one of these cranes is shown on page 188. This particular crane was arranged with two trolleys so that work could be going on at two different points at one and the same time.

We have supplied a large number of cranes of this kind for work in shops and particularly over the crushing and grinding mills in sugar cane factories. Accidents are always liable to happen to the rolls and as they are of very considerable weight it is awkward and difficult to quickly move them from their position and place new rolls in the mills. With this apparatus it is very easy for a few men in a short time to remove a roll and put a new one in position. The load is raised and lowered by a differential block, which is operated by hand chains reaching to the floor. The cross motion of the trolley is also operated by means of hand chains which run to the floor. The longitudinal motion of the entire crane on the track is controlled by two chains, one at either end of the crane which operate a longitudinal shaft, which in turn is geared to the driving wheels at either end and thus moves the crane along. It is entirely possible to have all three of the mechanical movements, that is, the hoist, the transverse motion and the longitudinal motion in operation at one and the same time.

These cranes can easily be built to span sixty feet, or even greater if necessity demands, and of course, the length of the track is unlimited. Nearly any ordinary load can be lifted, but, of course, the greater the load the slower it has to move with a given number of men. About the largest load to be lifted as a rule in sugar factories is from ten to fifteen tons.

It is necessary, on account of the transverse motion, to have the track girders securely held in position. It will be noticed that on Plate No. 53 the column supporting the track girders is shown different on the right hand side of the drawing than on the left. The left hand drawing is intended to represent a form of construction which braces the track girders and is used in places where no brace to any rigid structure can be had. The column on the right is intended to represent the form of column to be used where the track girders can be braced to some existing structure, for instance, in a building. It will be noticed in the photograph on page 188 that this particular column was used, but in this case the track girders were braced sidewise to the building. This prevents the structure swaying when the cross motion of the crane is used.

Plate No. 54 shows the same class of machine as Plate No. 52 only for much heavier loads and to be operated by hand. Of course steam power can easily be employed in order to get quicker motion or raise larger loads.

We also construct large derricks to be operated by either hand or steam power. Plate No. 55 shows a derrick of this kind of very large capacity. This derrick is arranged with an automatic block on the back of the mast. This block is weighted and the derrick is so rigged that the main hoisting rope will descend automatically after the load has been raised and lifted. We are in a position to make prices on derricks with a boom of almost any length and of almost any capacity. We have constructed a number of these derricks, one of which is the largest in the world and has been working most satisfactorily for a period of five or six years. This is shown in a picture on page 189. These derricks have wire guys from the top of the mast, which must be securely fastened to immovable points.

Plate No. 56 shows a derrick constructed on the same general principles as the derrick shown on Plate No. 55, except that it is intended to be used on docks or wharfs where it is impossible to run guy lines in front of the derrick; consequently the mast has to be held in position by two stiff legs securely fastened to foundations. This form of construction is specially used in Government wharfs, ship yards, etc., where boilers and engines have to be raised from vessels. A mechanical arrangement is used at the foot to revolve the derrick by power. This is also shown in this view. These derricks can also be made with any length boom and of any capacity.

Plate No. 52.

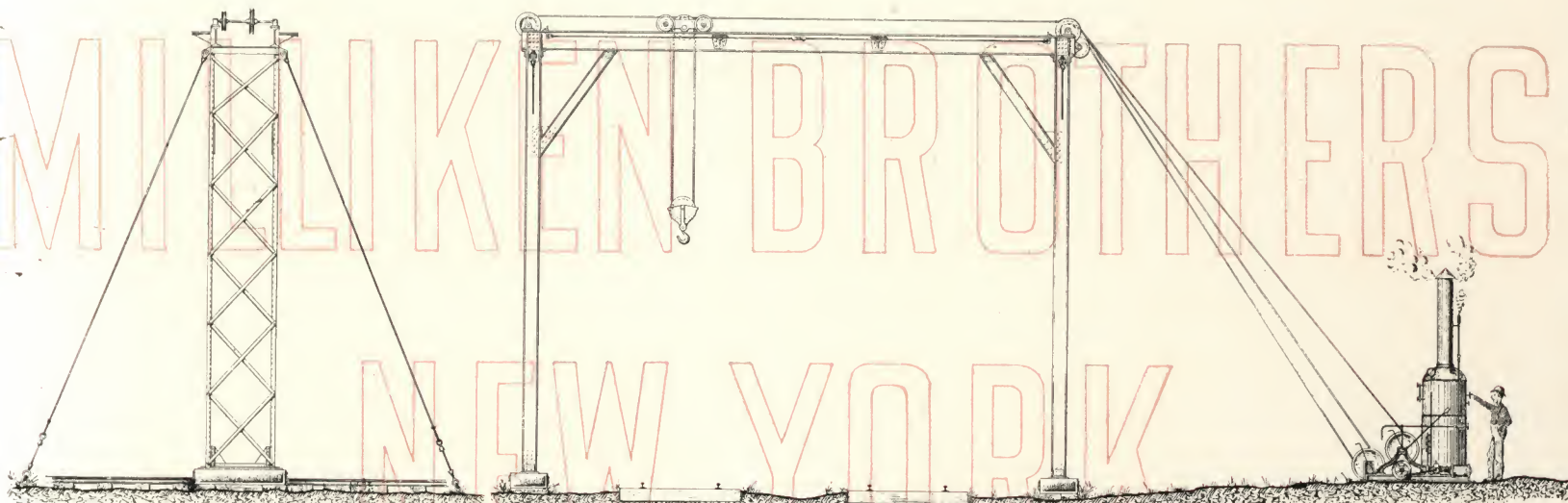


Plate No. 53.

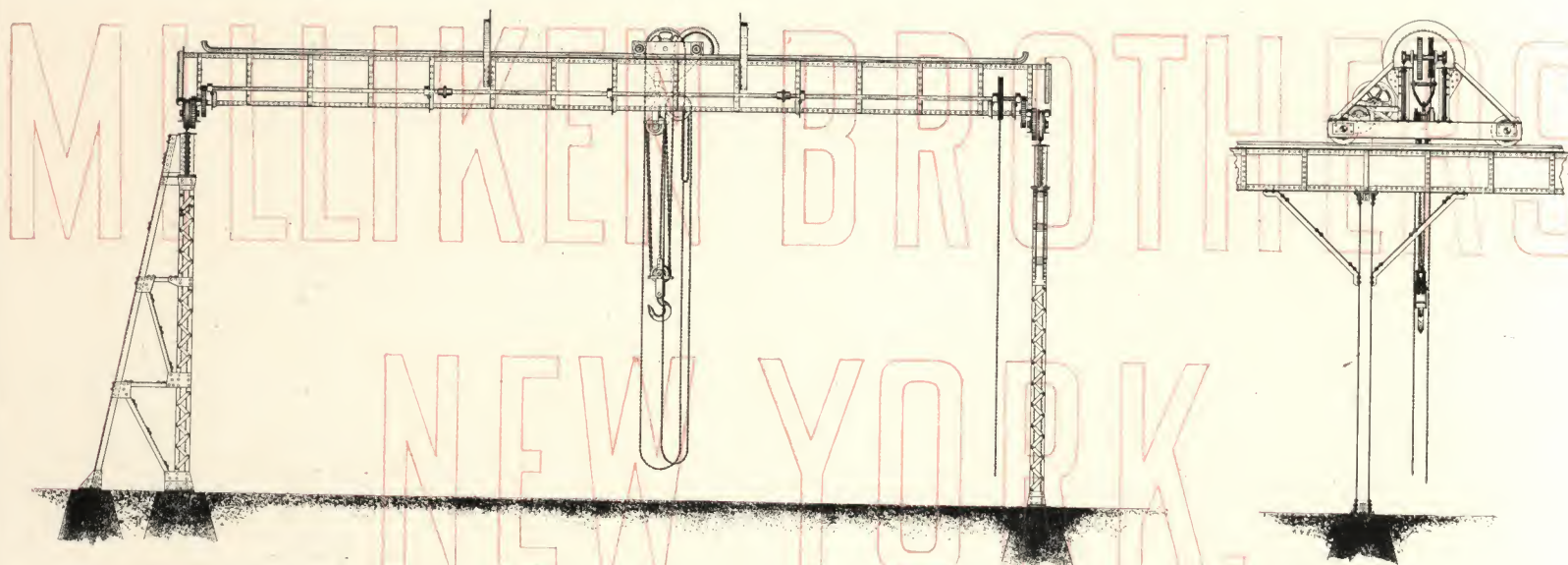


Plate No. 54.

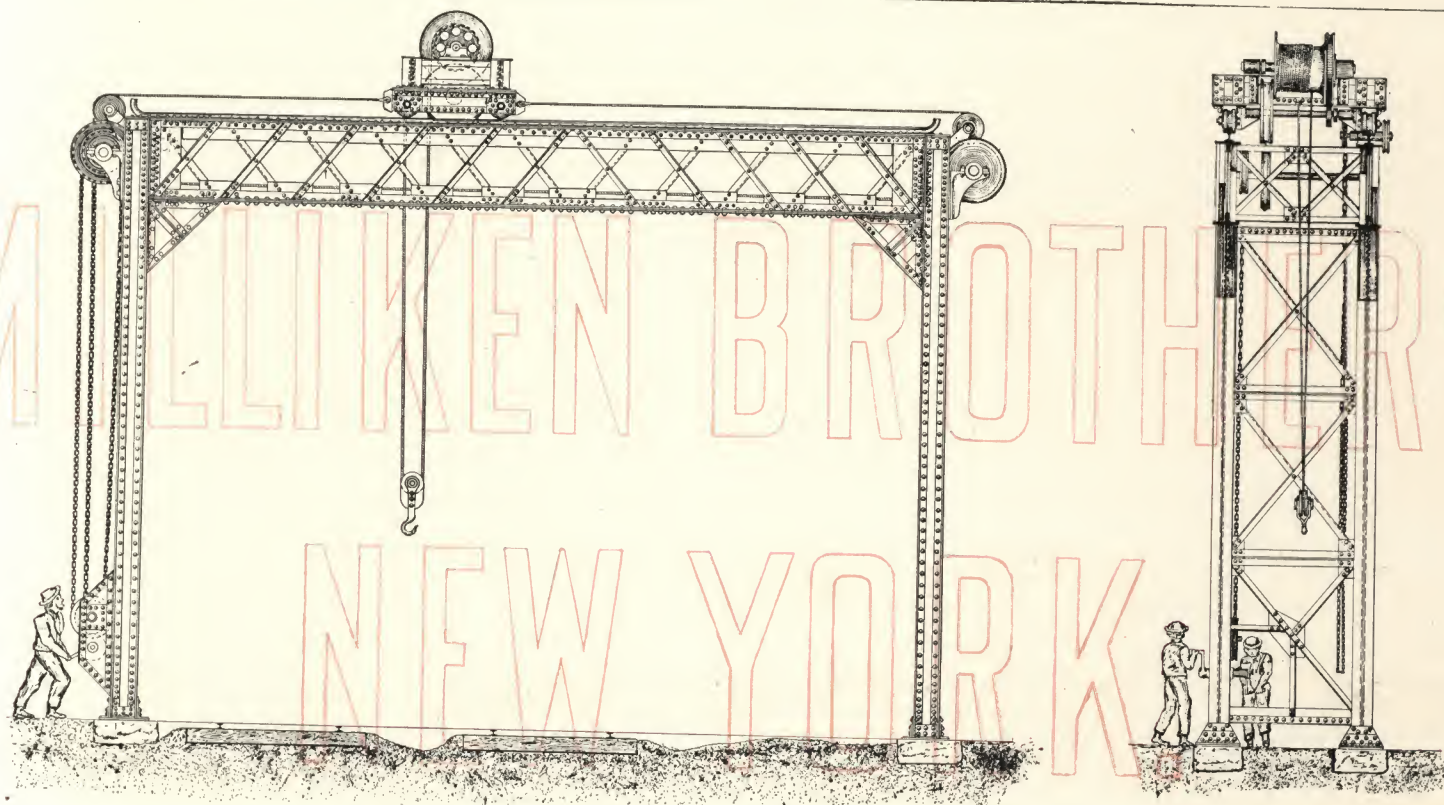


Plate No. 55.

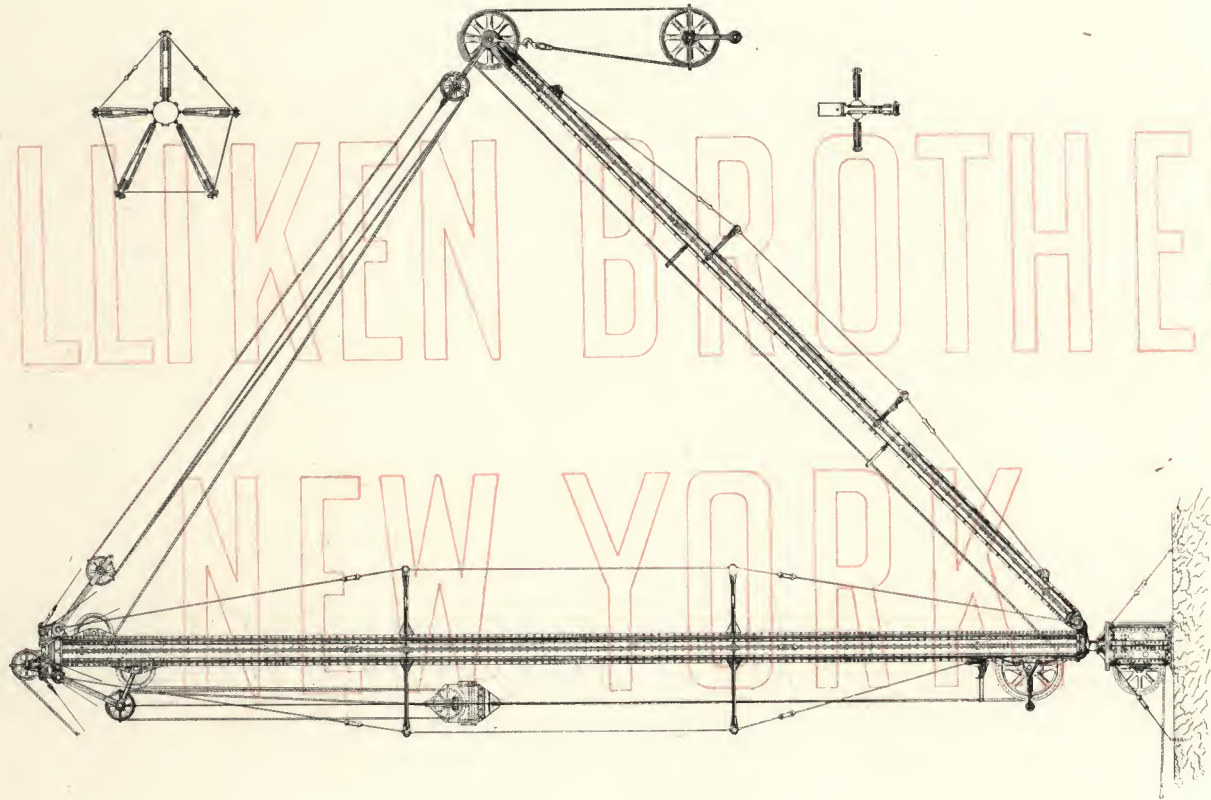
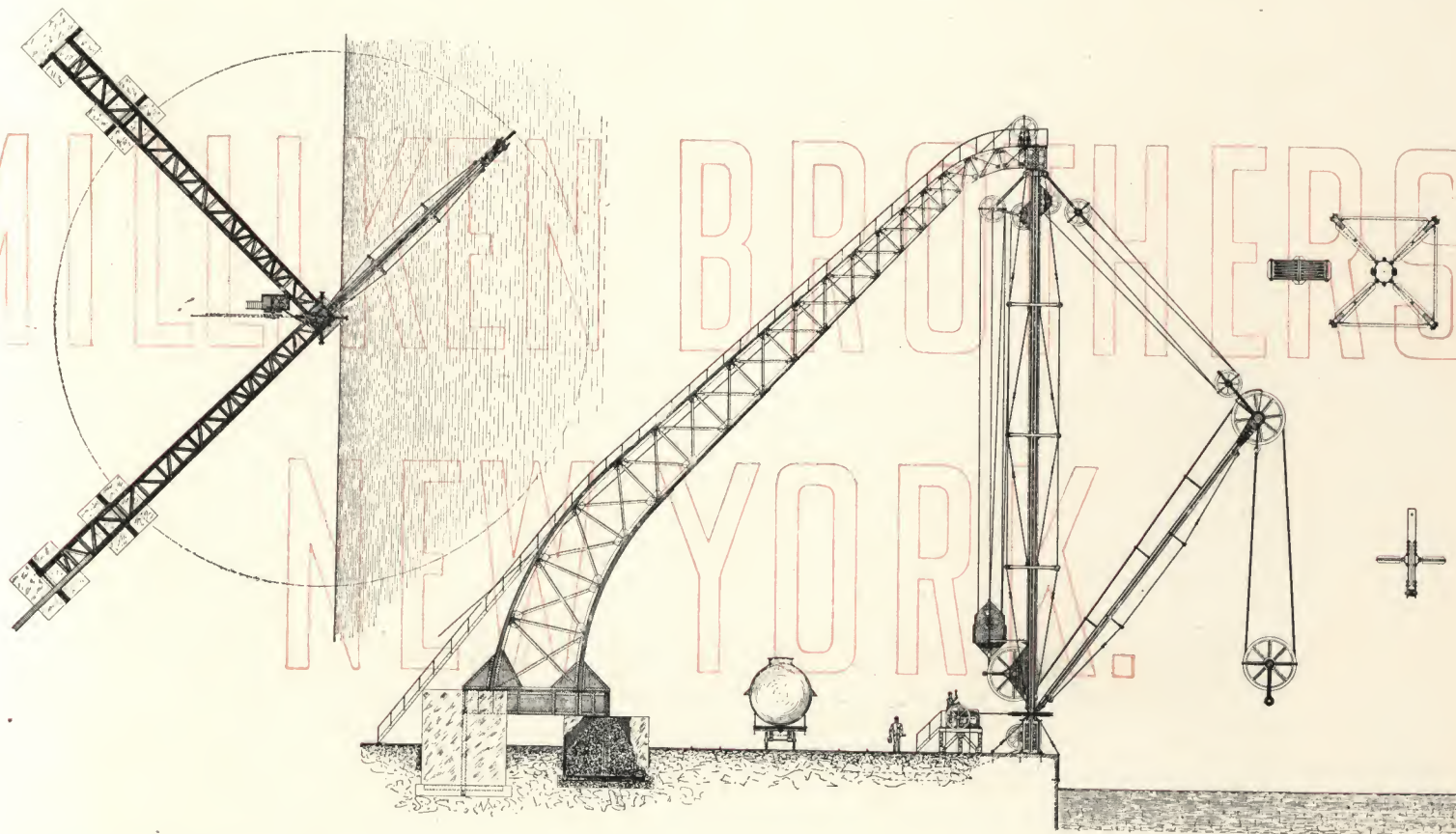
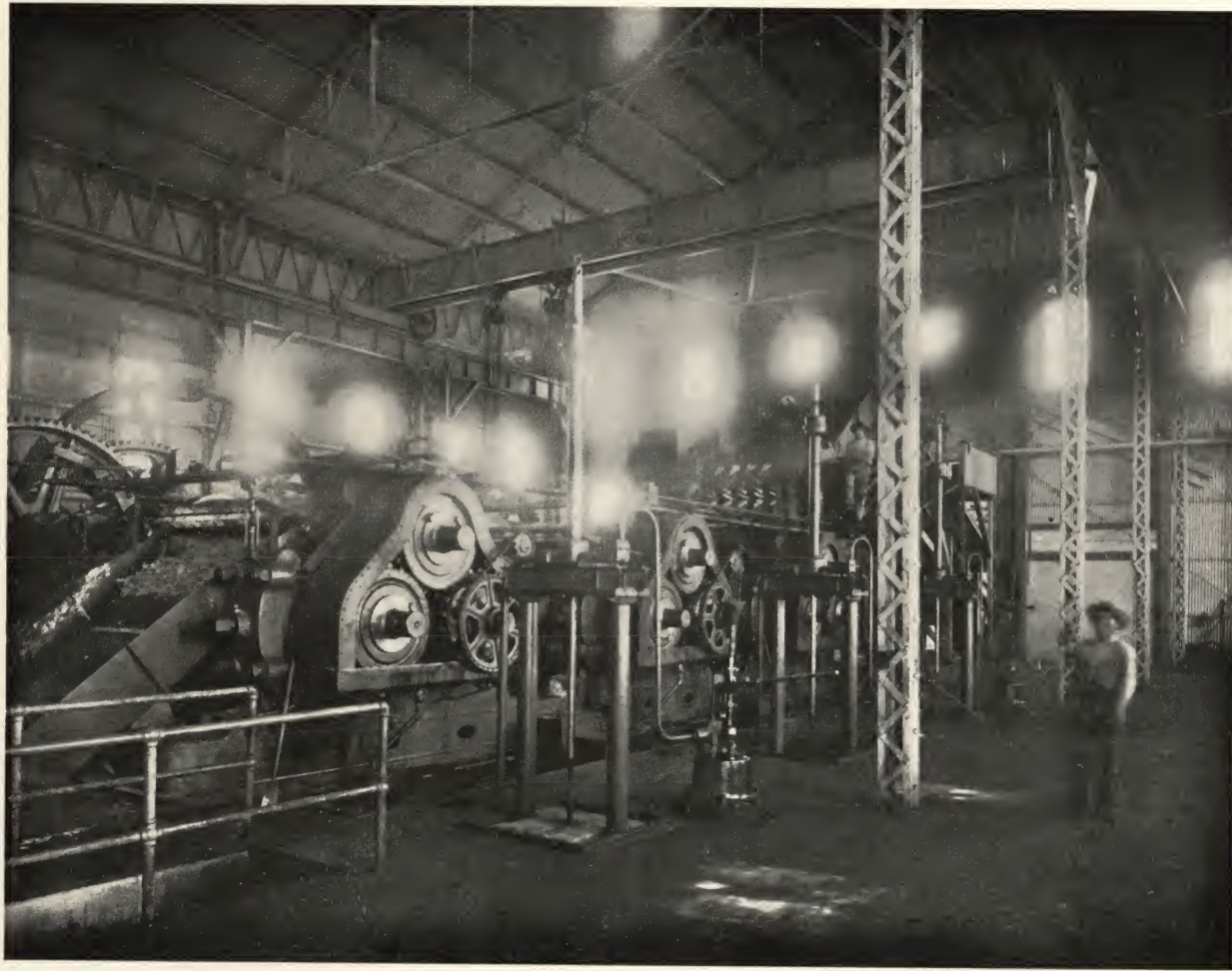


Plate No. 56.

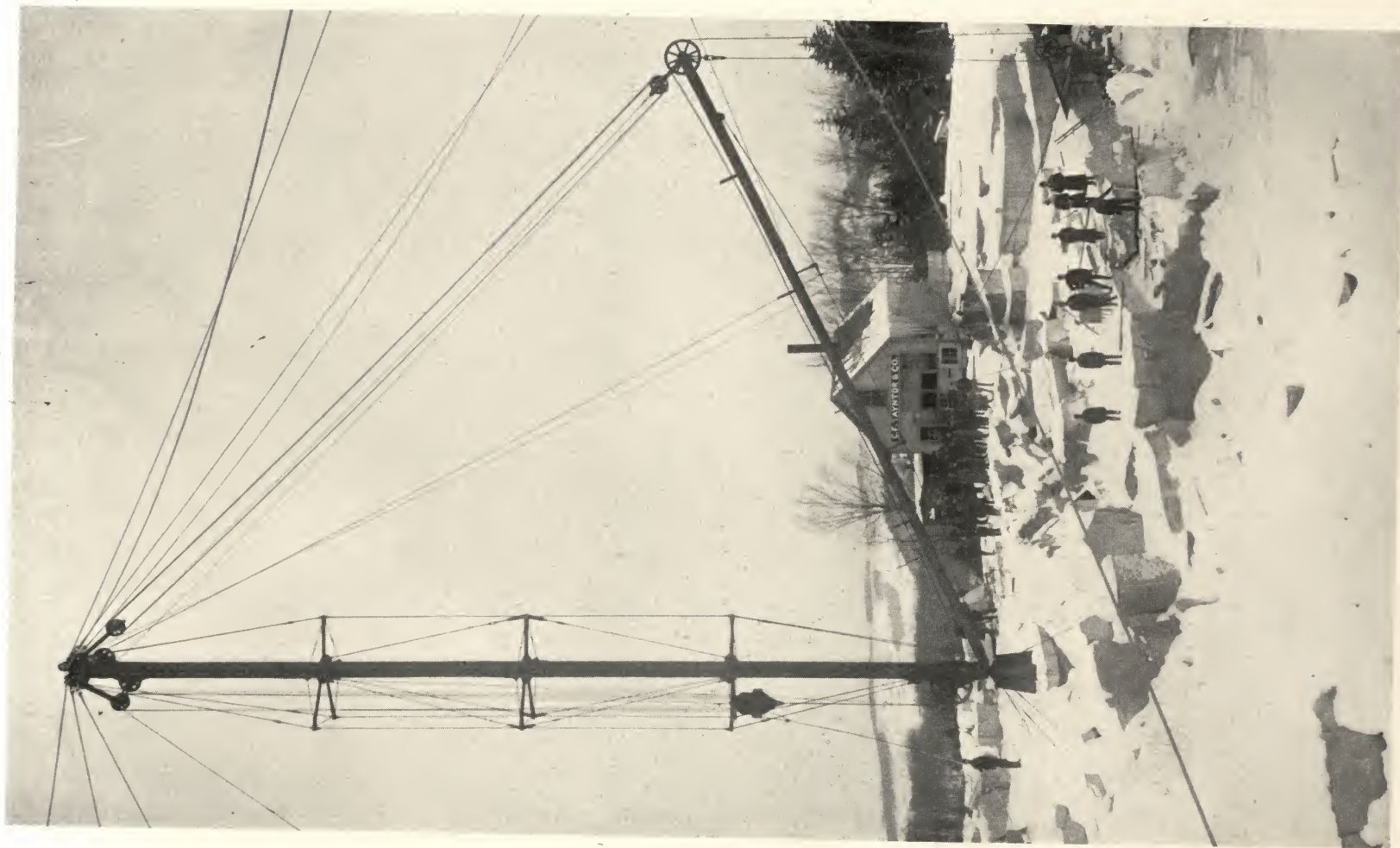


OAHU SUGAR CO., HONOLULU, H. I.



STEEL WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

C. E. TAYNTOR & CO., GRANITE QUARRY, BARRE, VT.



WORK DESIGNED AND FURNISHED BY MILLIKEN BROTHERS.

TANK AND BELL TOWERS.

On Sugar Plantations and in cities it is often advisable to have a light, ornamentally constructed tower containing a platform at the top, and a bell to be used for fire alarms. Plate No. 57 shows this class of work in detail. The platform is reached by a ladder running up the side and the top is covered with an ornamental corrugated galvanized iron roof. In cases where it is desired to protect the person on watch, the sides of the top of this tower are enclosed with glass windows, and a door for access.

Plate No. 58 shows the same general form of construction for the use of elevated tanks. It is often desirable, in order to obtain water pressure, to elevate the source of supply. This is very desirable for fire purposes. Any height can be reached and any size tank can be carried.

Plate No. 57.

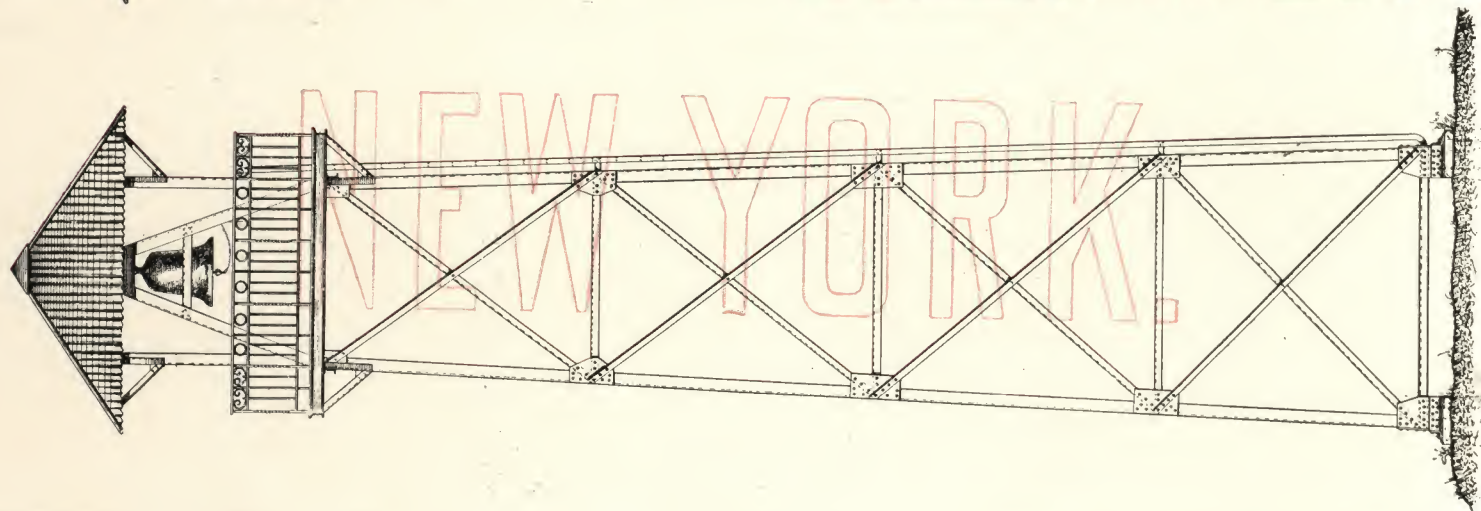
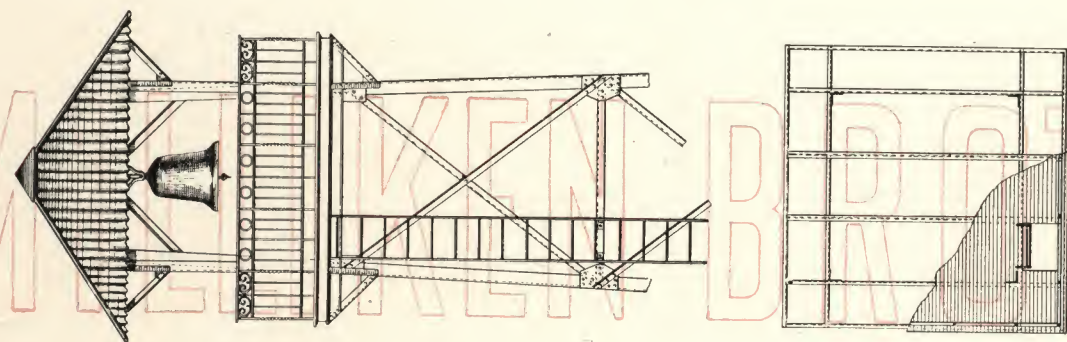
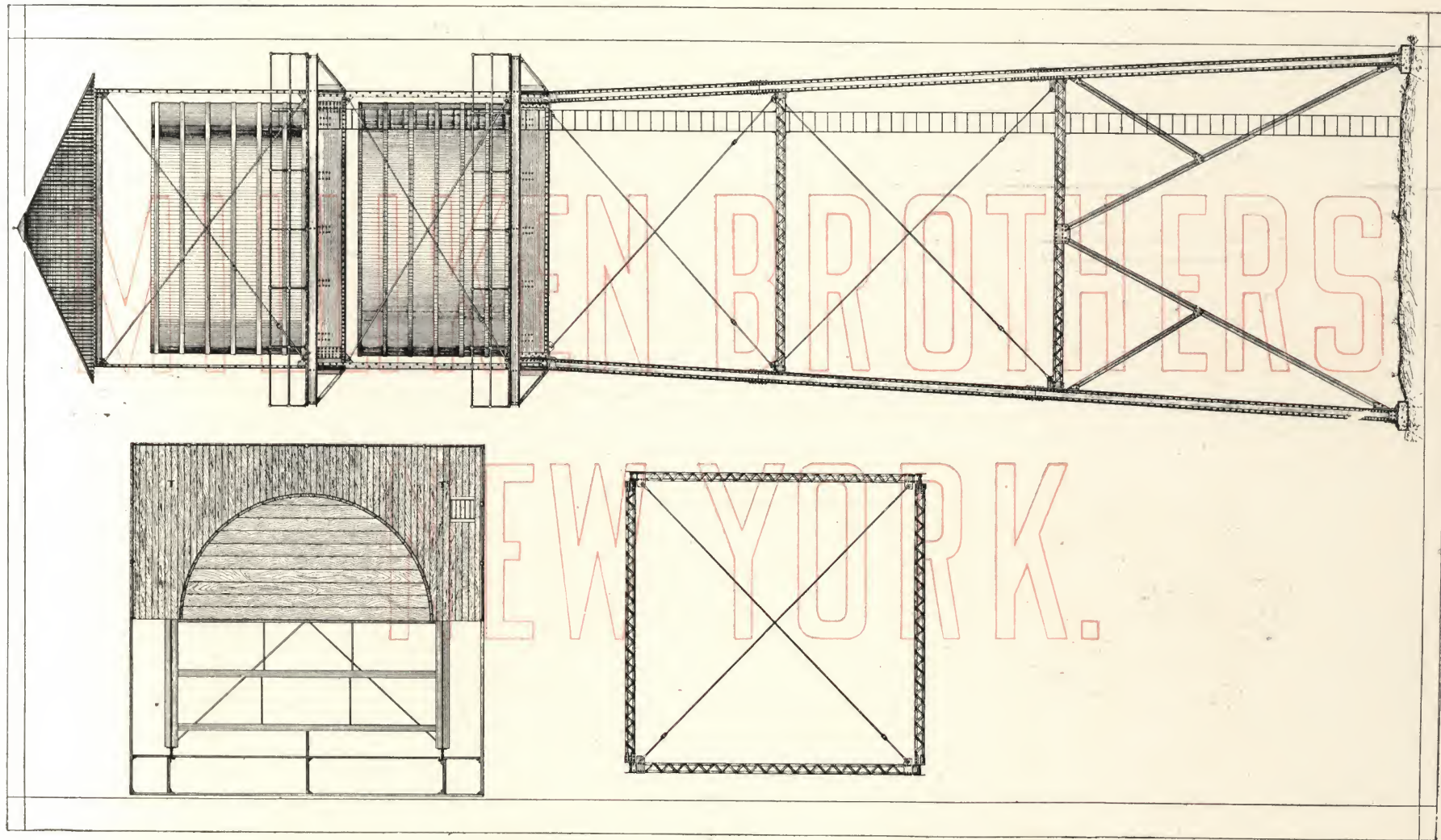


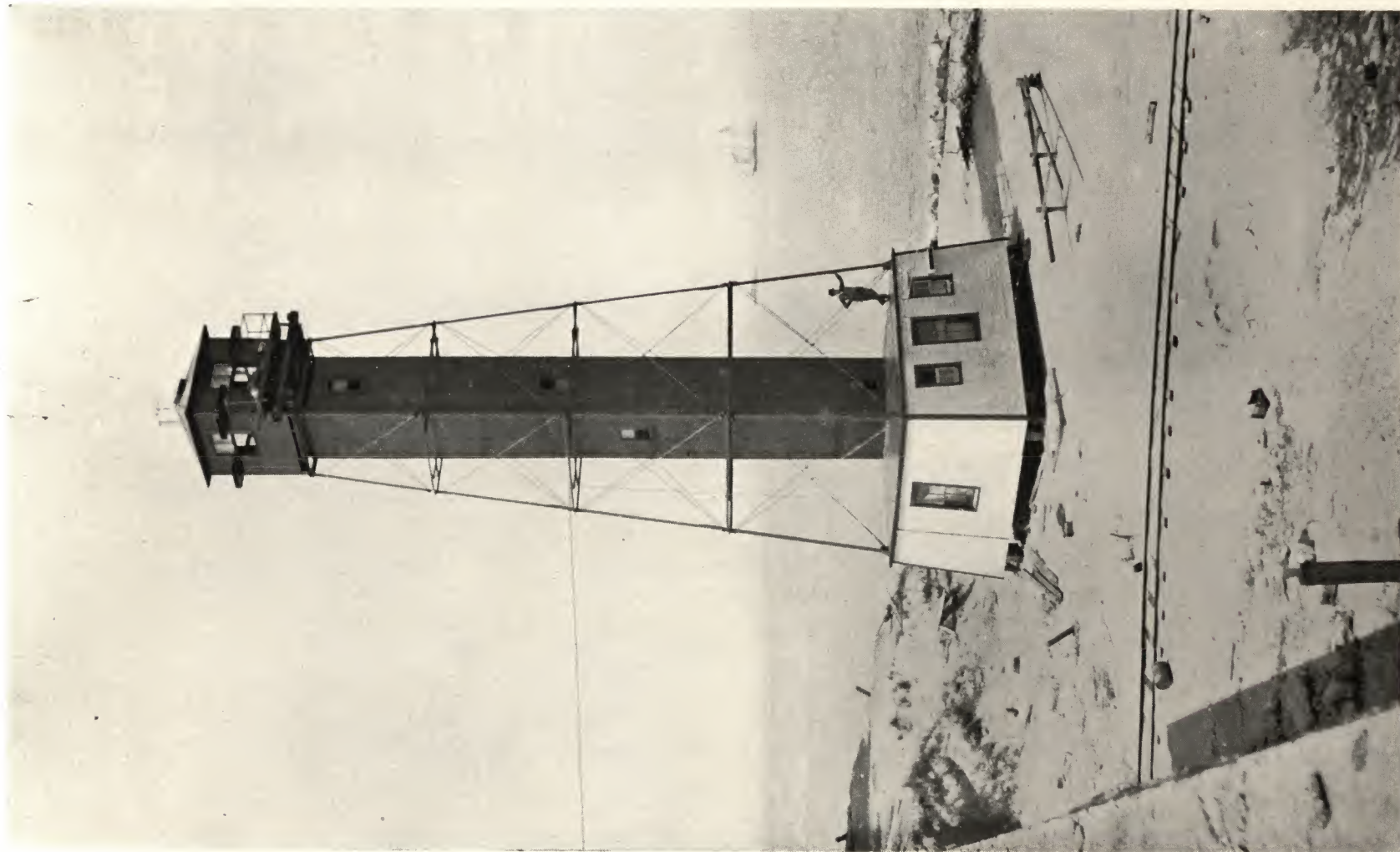
Plate No. 58.



THE UNIVERSITY OF CHICAGO
LIBRARY

1891

LOOKOUT TOWER, POSTAL TELEGRAPH COMPANY, SANDY HOOK, N. J.



WORK DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DOCKS—PIERS.

In Southern countries where the teredo and other insects which attack wood are very active, the use of wood for piles has to be done away with and some other form of construction used. Occasionally cast iron, and in a number of instances, wrought steel columns are employed, which are sunk or driven into the sand, or in other manner anchored to the bottom. These columns are then braced by means of tie rods and struts to prevent lateral deformation, and on top of the beams connecting the columns at their top, planks are laid to form the deck of the pier. Plate No. 59 shows this construction in detail.

We find that one of the cheapest and best forms of construction to use is Phoenix columns. On the bottom of the column is fastened a screw, which has two or three holes in the same. The top of the column is closed by a plate and a stream of water under pressure is forced into the column and has its exit through the holes in the bottom of the screw. By slightly moving the column in the sand the column will gradually sink, owing to the action of the water washing the sand from beneath the bottom of the column, and the columns in this manner can be easily and securely fastened in position. Of course this method of sinking the column is only applicable where the dock or pier is built on a sandy bottom.

We are prepared to furnish estimates for supplying any proposed form of construction; also for supplying the wooden fenders, flooring, mooring posts, steps, davits, and any other apparatus required.

In order to protect goods that are liable to be stored on a pier for any length of time, it is customary to cover in the the top of the pier. This is shown on Plate No. 60. This form of construction is one universally adopted on all of the docks in New York City, and in some cases the pier is made two stories and goods are stored in the upper story, and it is also a great convenience to have passengers landed there in case of extremely large ships and vessels. The sides of the pier are battered so as to clear the sides of the vessel when making fast to the pier. The roof and sides of these piers are usually covered with corrugated galvanized sheet iron. The light is admitted through the monitor sash and through windows located at convenient points in the sides of the structure. Large rolling steel shutter doors are usually used to cover the openings through which freight is moved.

Plate No. 59.

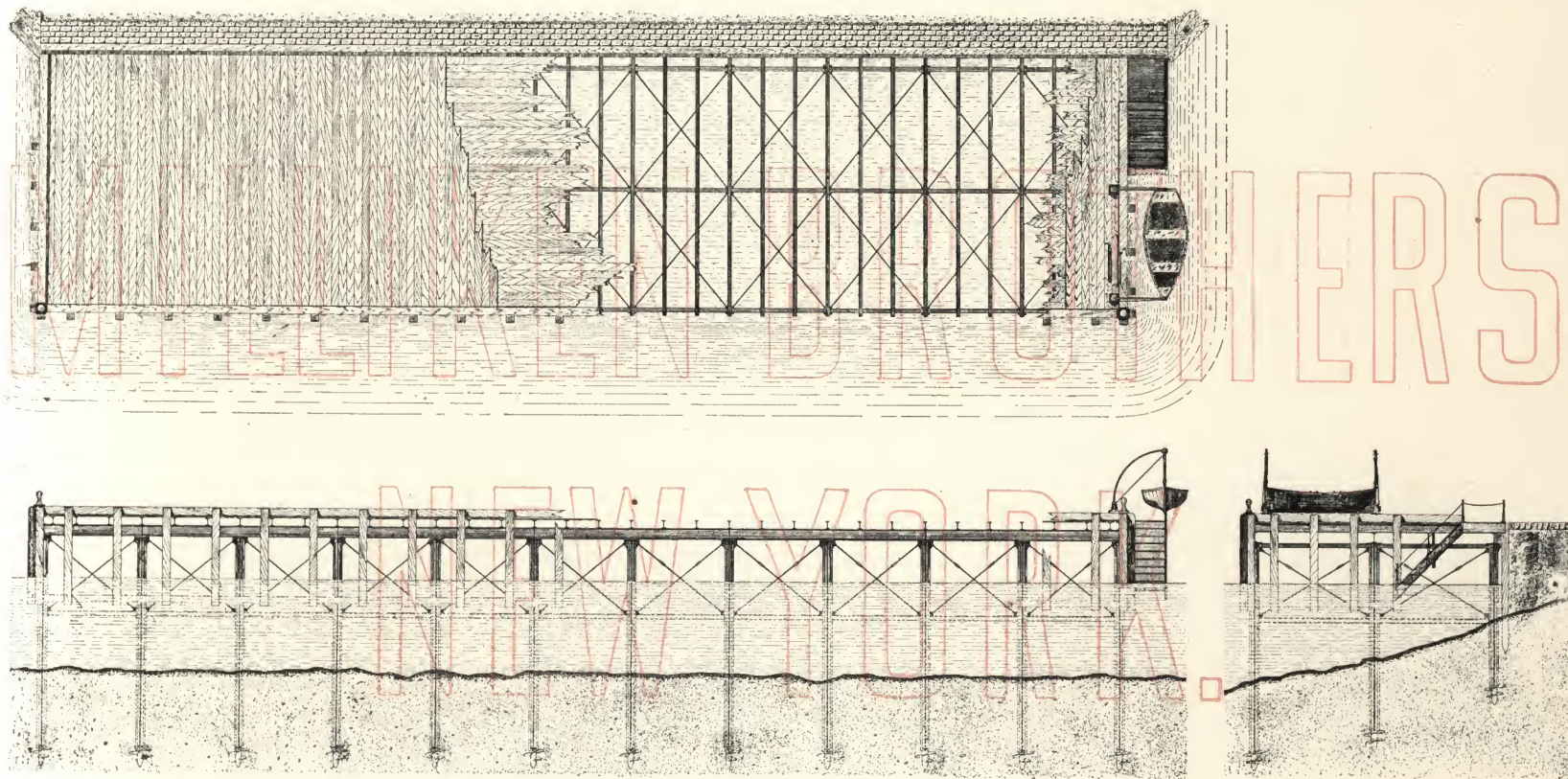
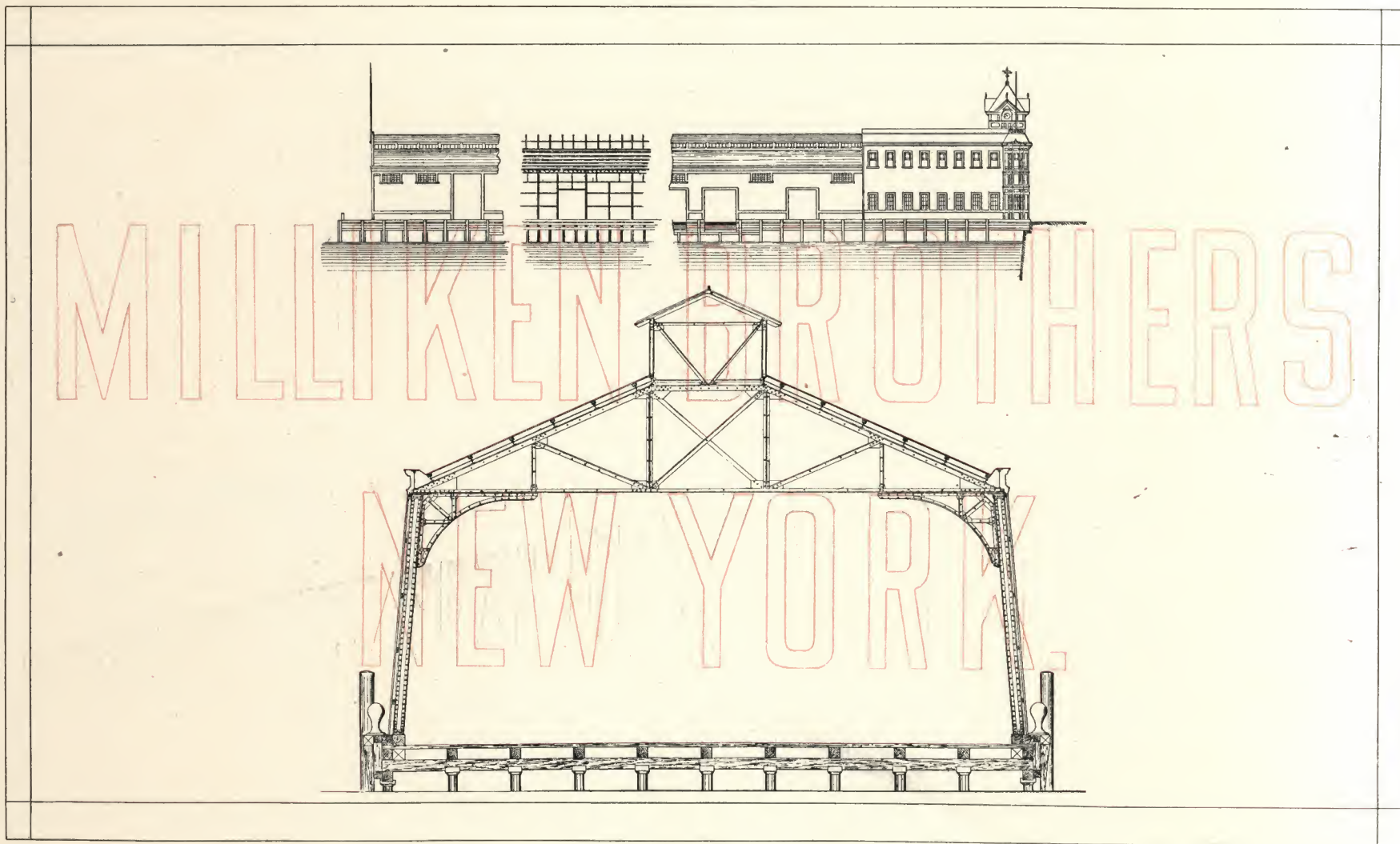


Plate No. 60.



HIGHWAY AND RAILWAY BRIDGES.

The use of wood or of wood and iron in bridges is entirely obsolete, and now all bridges are constructed of steel. For bridges of very short span, all that is necessary is to use a few I beams, and same can readily be calculated from the tables given in the first part of this catalogue.

When the span becomes greater than a simple beam will carry, it is necessary to construct the main trusses of riveted material. Plate No. 61 shows a small foot bridge of this description. using a lattice truss.

When the span exceeds a certain width a much deeper truss is used, as shown on Plate No. 62. Plate No. 63 shows a foot or carriage bridge where a clear span is not necessary and where a part can be supported on piers with columns. In designing this class of structure, of course we have to know the clear span, the width and the use to which the bridge is intended to be put; in other words, the greatest load which will at any time pass over said structure, and also the character of the railings, guards, etc. We can furnish railings, plain or ornamental, with lamp posts and other ornamental work as may be desired.

Plate No. 64 shows a plate girder railroad bridge. In designing plate girders we are limited somewhat in exporting material to the capacity of vessels to take the finished members. Of course plate girders can be furnished in pieces and riveted up at the destination, but in such a case, owing to the design it would be necessary to ship them with hardly any riveting done on them.

Plate No. 65 shows a railroad span bridge, using what is called a "pony truss." It is not desirable to use this form of bridge for any very long span, owing to the fact that the top chord cannot be braced and is liable to get out of line, making the carrying capacity of the truss very small.

Plate No. 66 shows a truss of considerably greater span where the top chord is braced to prevent the trouble above referred to. This last named bridge can be made of almost any length.

Plate No. 67 shows a design for an elevated railroad structure or viaduct. All of these views of railroad work show a single track. Of course double track can be used, and in designing the structures we have to know the span, whether it is single or double track, and full information relative to the weight of the engines, cars, position and location of the wheels, and the loads that come on them.

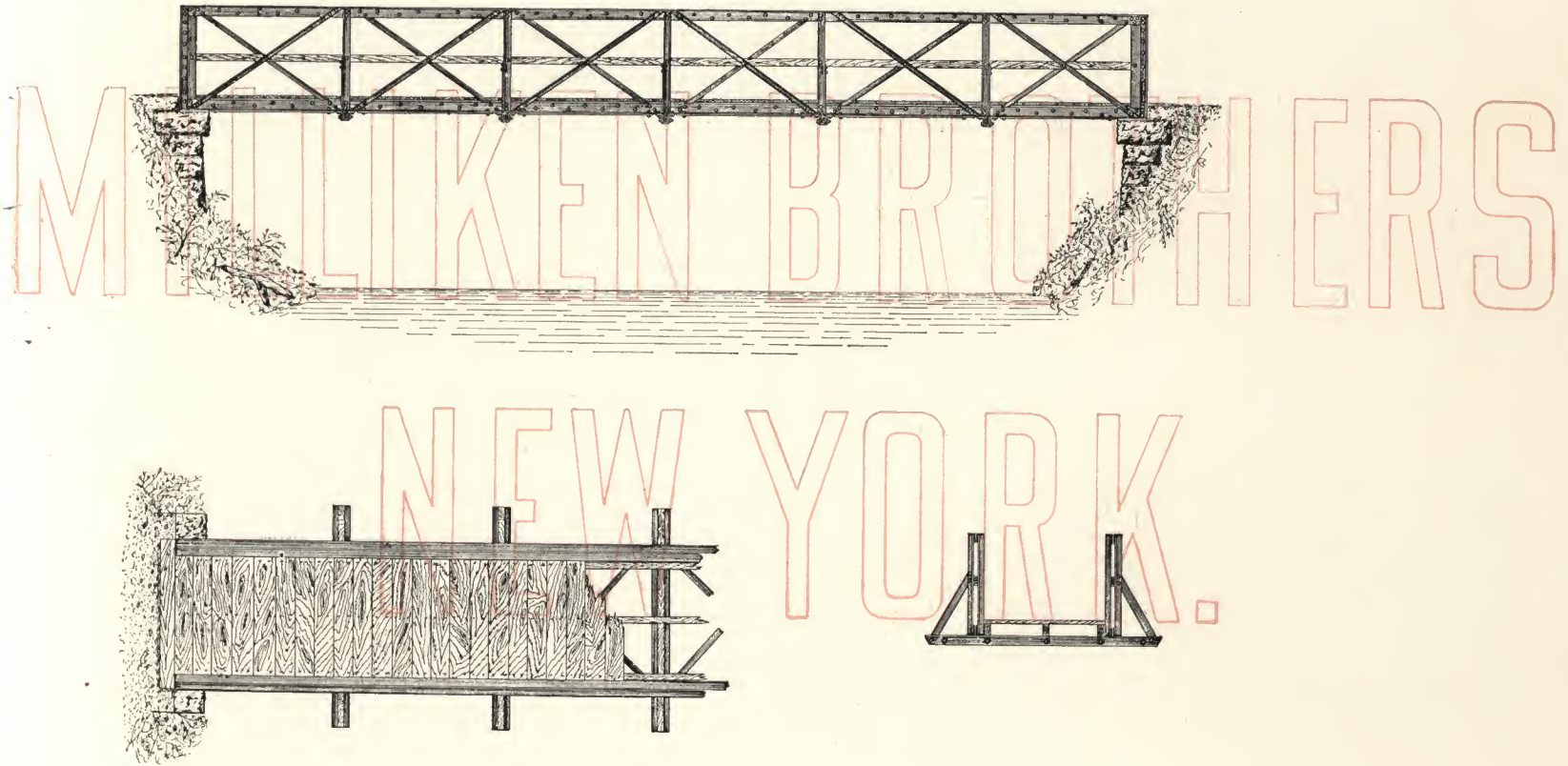


Plate No. 62.

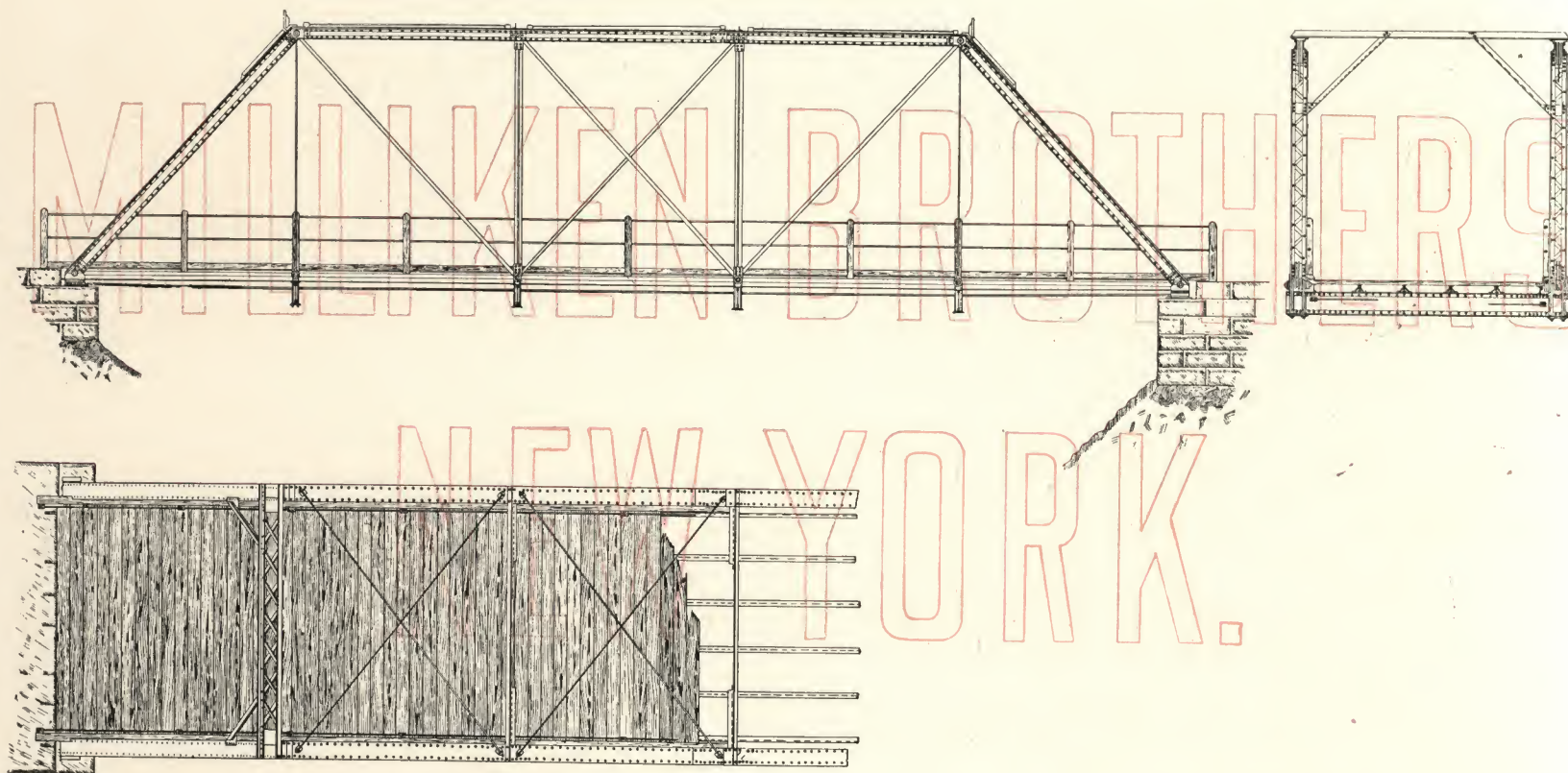


Plate No. 63.

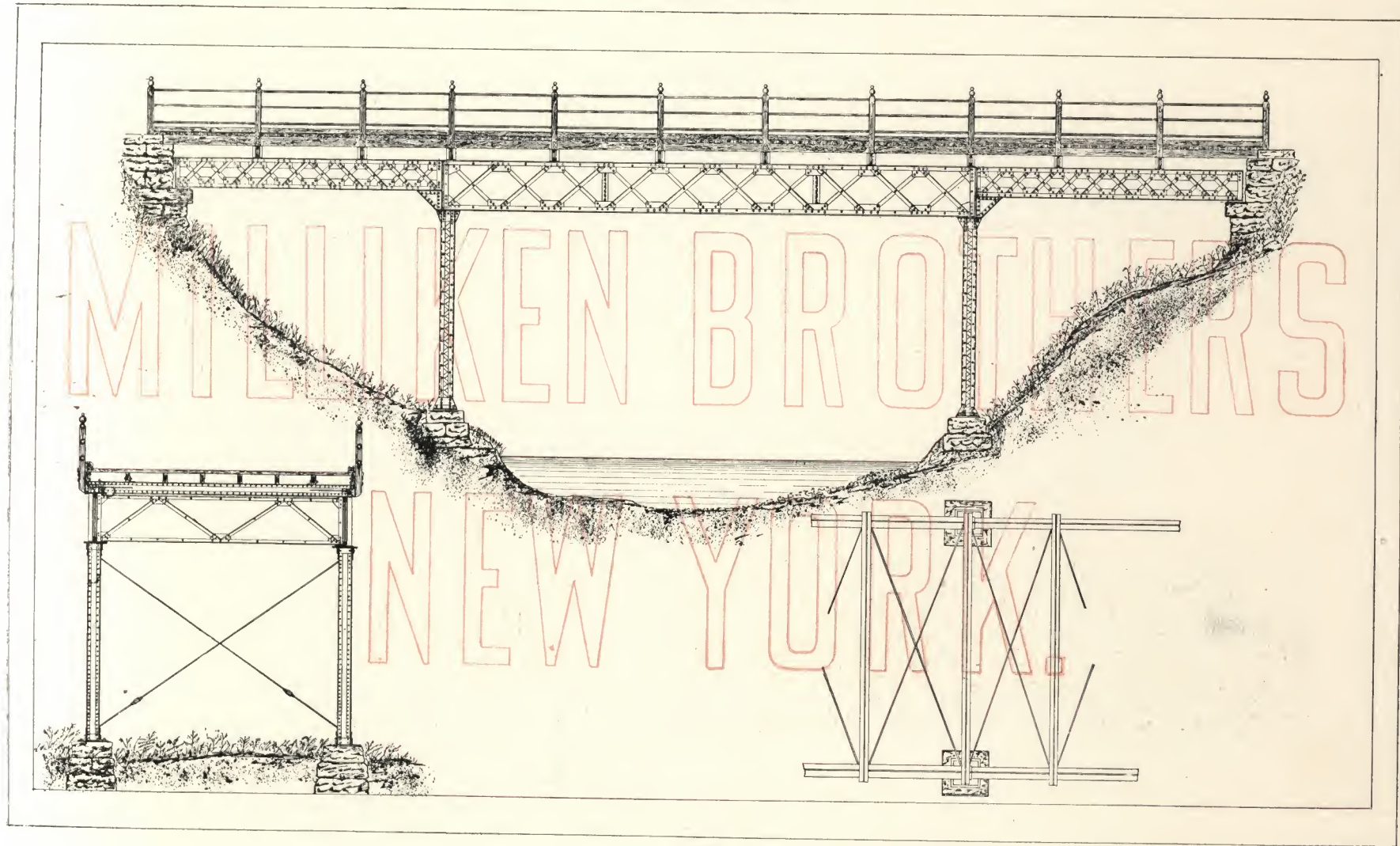


Plate No. 64.

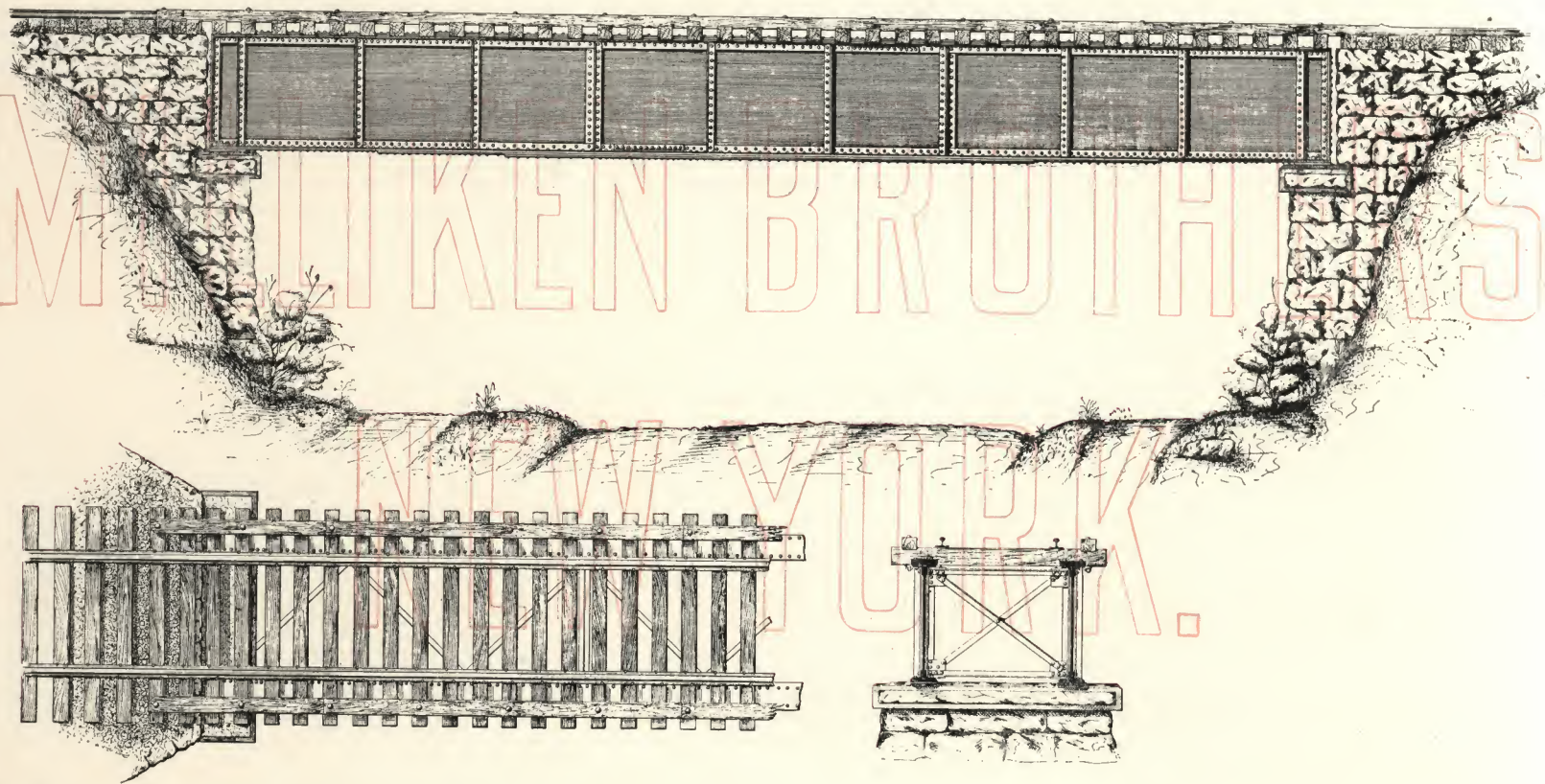


Plate No. 65.

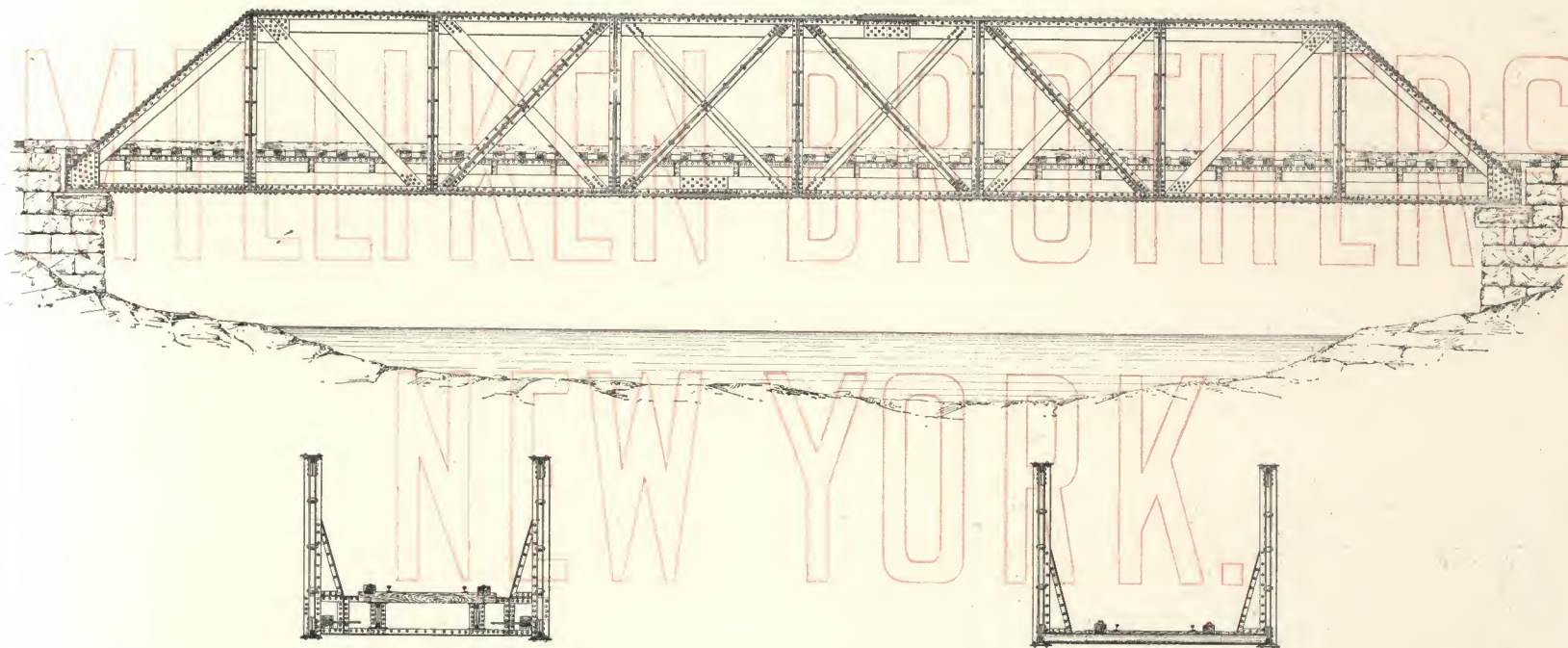


Plate No. 66.

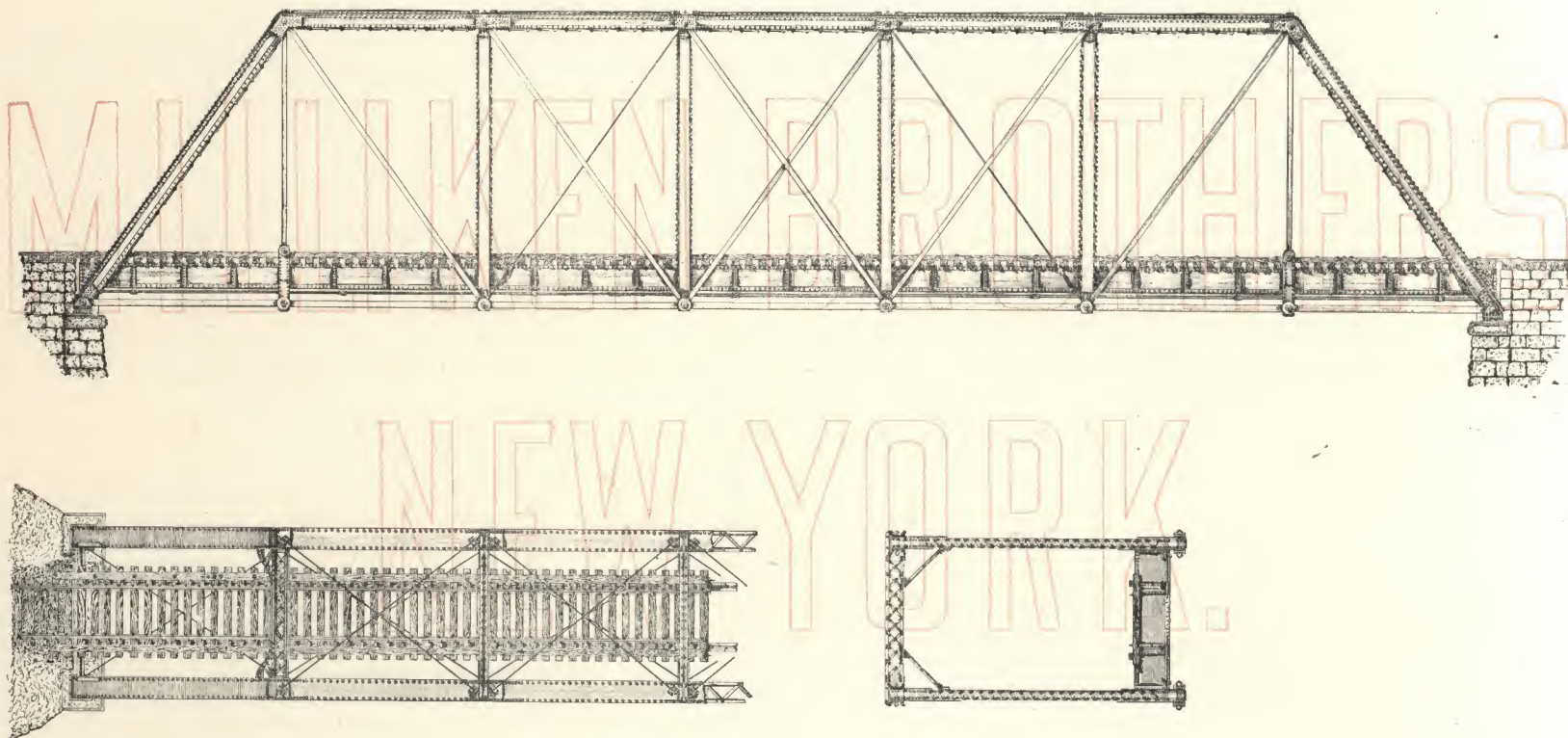
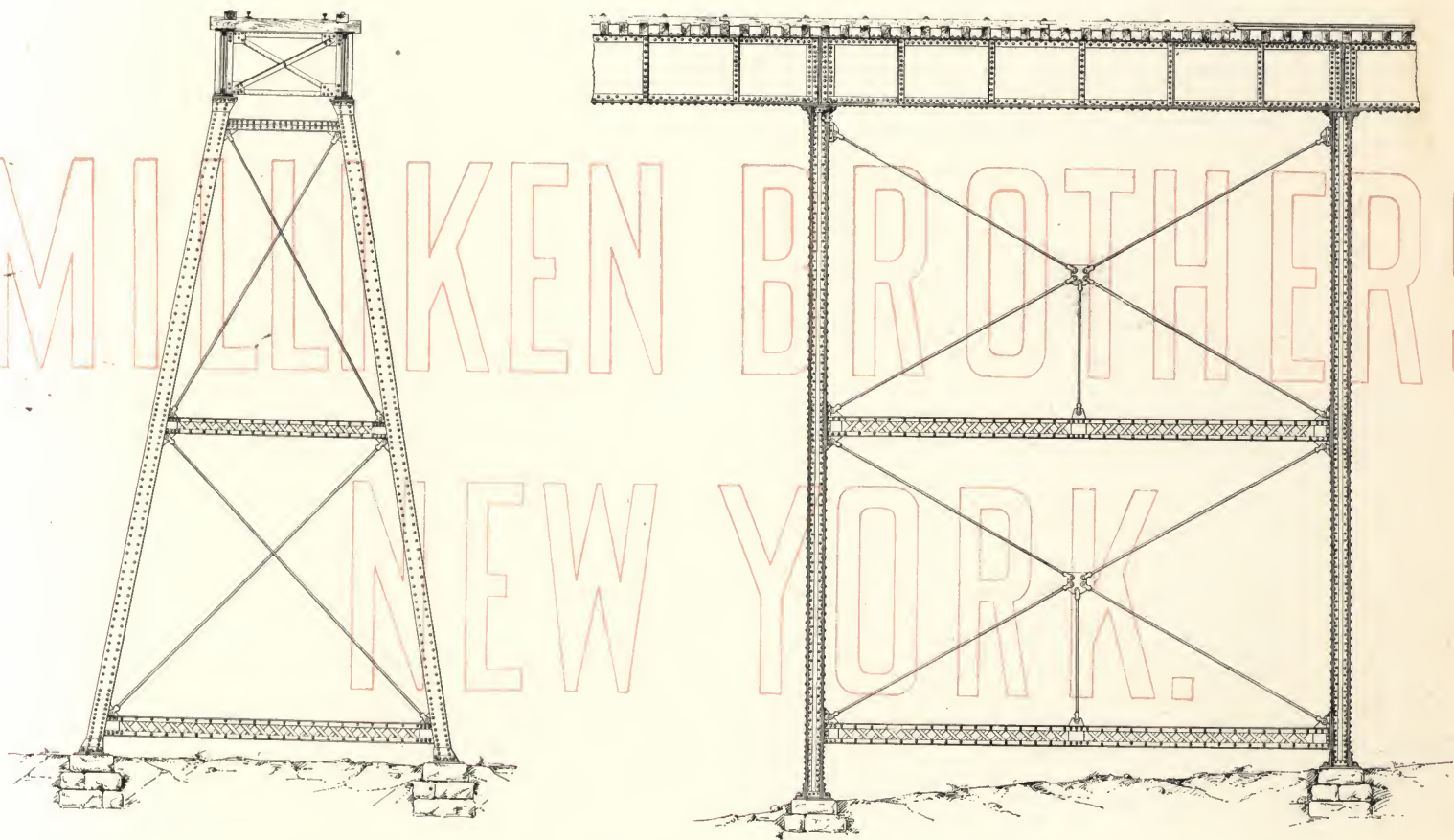


Plate No. 67.



HIGHWAY PLATE GIRDER BRIDGE, PROVIDENCE, R. I.



DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HIGHWAY PONY TRUSS BRIDGE, PLAINFIELD, N. J.



DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

HIGHWAY TRUSS BRIDGE, THREE BRIDGES, N. J.



DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

STOCKTON STREET CROSSING, CENTRAL RAILROAD OF N. J., PHILLIPSBURG, N. J.



DESIGNED, FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DRAWINGS.

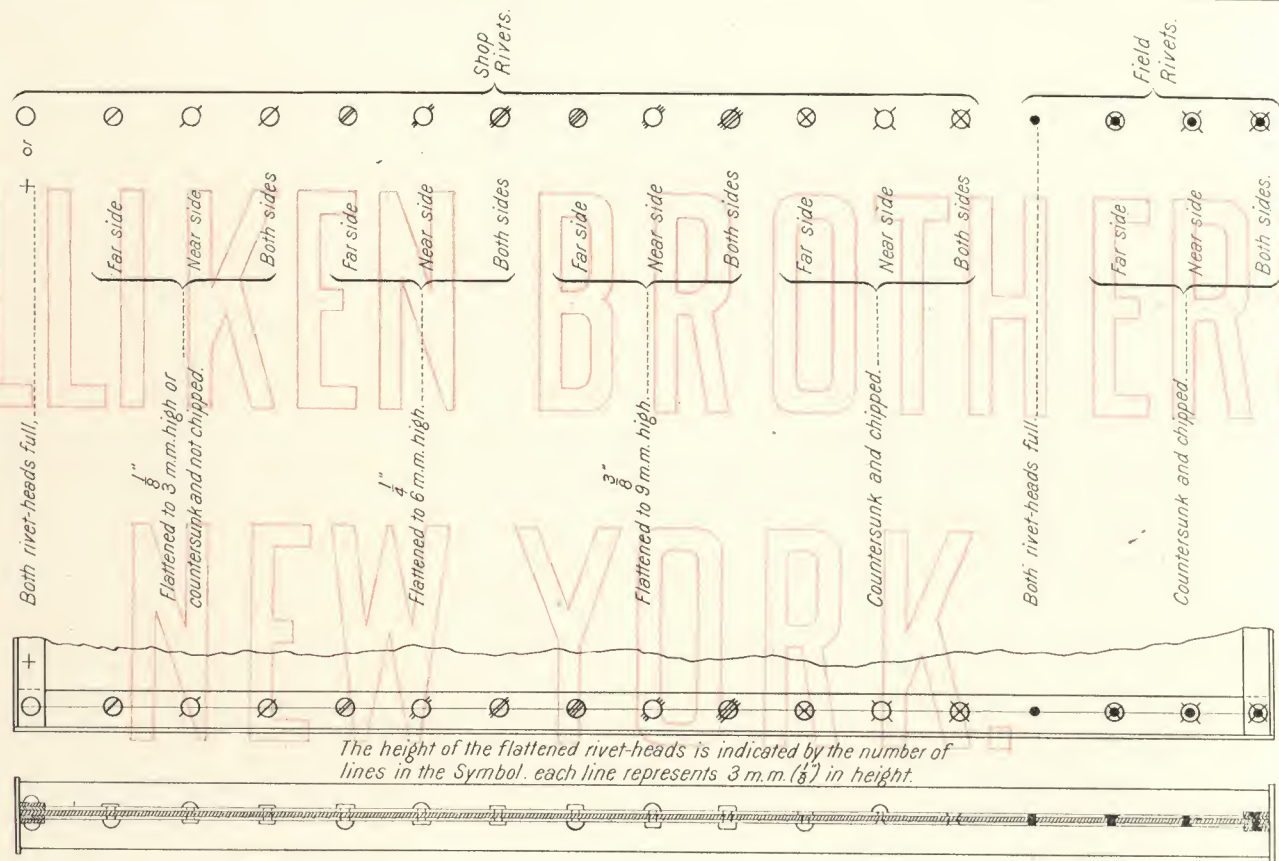
With each shipment of goods, where the owners attend to the erection, we make a specialty of furnishing complete detailed drawings showing the marks and location of the pieces, so that it is impossible to make any mistake in assembling or putting together the members. Also a complete list of all the bolts, rivets and other fittings. In order to intelligently understand the signs or symbols used on said drawings, we refer our customers to Plate No. 68, which gives the symbol for rivets and a sketch showing the meaning of these symbols. In the case of bolts, rivets and small pieces, we invariably send an excess quantity to provide against accidental losses in erection.

Where parties so order it, we send a complete list and furnish the tools necessary for erecting purposes, such as hammers, chisels, rivet forges, and in many cases, steam hoisting engines.

In the case of sheet iron work, we send complete plans showing the marks and location of the sheets, gutters, casings, flashing, etc., and a full and complete specification, and instructions as to how the parts are to be constructed, and in cases where the owners order it, we send the special tools necessary to put this work up. We always send a certain percentage in excess of the actual number of the small pieces required for connecting the sheet metal work, for the reasons given above.

In cases where parties order it, we are in a position to send out capable erectors on all classes of work, and superintendents to take charge of the erection of buildings, bridges, etc.

Conventional Symbols for riveting.



ORNAMENTAL CAST IRON COLUMNS FOR BUILDINGS.

We furnish ornamental cast iron columns for buildings. These columns can be either round or square, with plain or fluted shafts, and can be made with caps of Corinthian, Ionic, Romanesque, Gothic or of plain moulded design with bases to correspond. See Plate No. 69. Caps and bases of any special design can be made to order. These columns can be made of sufficient thickness to carry the weight of the building and thus take the place of plain supporting columns; or we can furnish them simply as shells, made in halves, to be placed around the structural or supporting columns. See column on page 249 with Corinthian cap, base and band. These columns support the floor of a store building and are placed in rows, giving a highly ornamental effect. The two columns shown on page 218, one at each side of the main entrance, are made of solid bronze, and are built up in sections as shells, encasing the supporting columns. These bronze columns give a very rich finish to the front of the building.

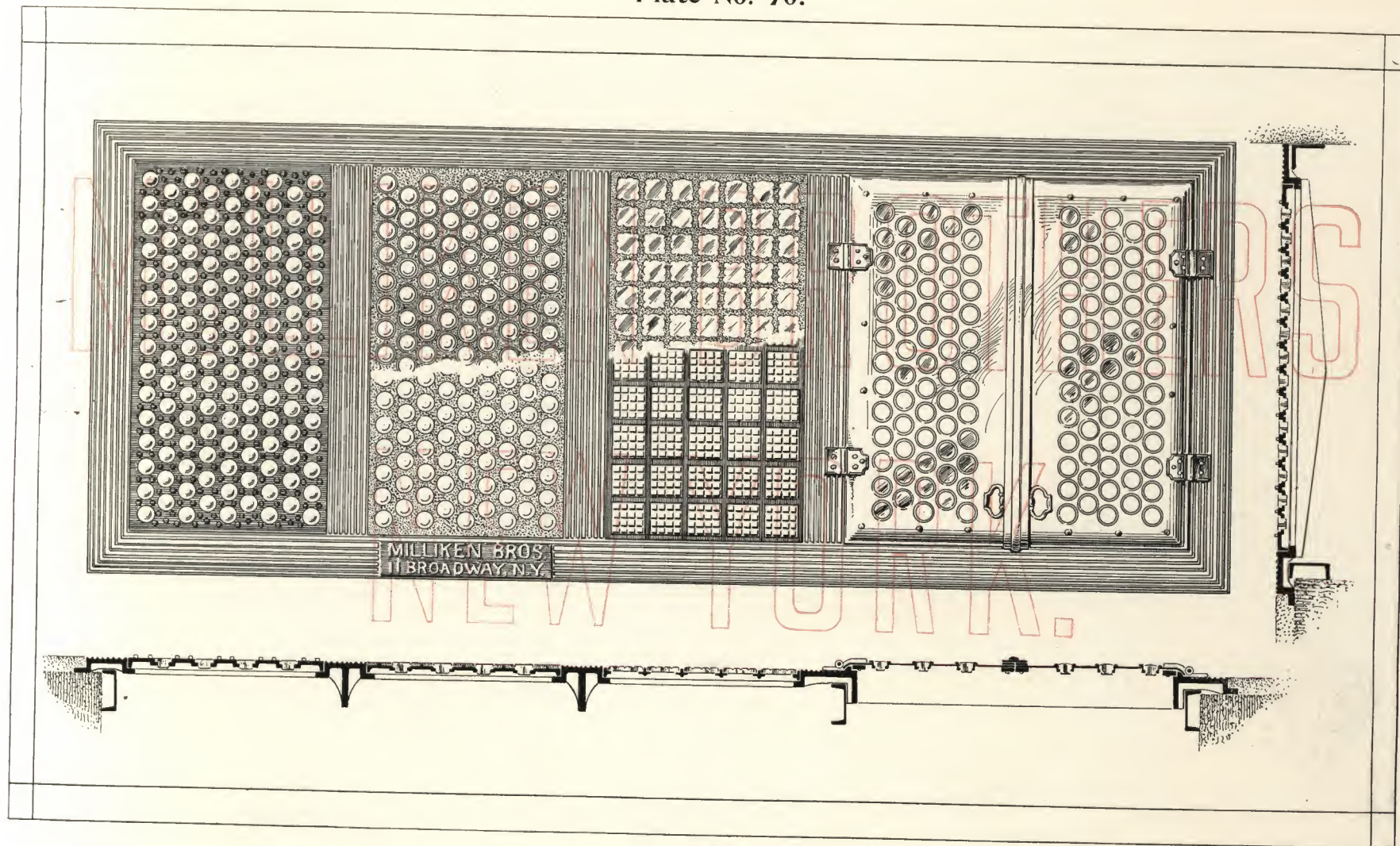
have brass hinges, padlocks and handles, also bars to brace them when open. Cheaper doors for sidewalks can be made of cast iron, with ordinary glass set in cement, instead of steel doors. Small doors can be lifted by hand; doors of very large size are furnished with worm gearing or quadrants by which same can be lifted from floor below. Doors are made absolutely water tight.

On page 216 we show a photograph of Illuminating Tiles, where the "Knob Light" is used in the sidewalk. These lights are in front of doorways where heavy goods are shipped. We also show steps with treads and risers with illuminating glass throwing the light down into the basement. The slanting doors are made of steel plates with lights set in brass rings. The small door is of similar construction and affords access to the boiler room under the sidewalk. The box ventilator has a glass top with ventilators or louvres at the sides for ventilating the boiler room.

We also furnish round covers and frames to be set in the sidewalk at the top of coal chutes, air shafts or for lighting vaults. Covers have either plain checkered tops or can be made of illuminating glass. We can also furnish these covers with open holes instead of glass, with a copper pan underneath to receive rain water. Between the pan and cover there is an open space for ventilation; and the rain water from the pan can be carried off by means of a small leader.

We also furnish glass for sidewalks of special design for radiating the light under the building itself instead of the light being thrown straight down. These lights are more expensive than the ordinary lights, and can be furnished in several designs.

Plate No. 70.



REAR OF 585-587 BROADWAY, NEW YORK.



IRON WORK FURNISHED AND SET BY MILLIKEN BROTHERS

CAST IRON ORNAMENTAL FRONT WORK FOR BUILDINGS.

On page 218 we show a photograph of ornamental cast iron frame-work for show window of department store, which is 18 feet high and 400 feet long with cast iron ventilating base between the sidewalk and bottom of show window and with cast iron ornamental and moulded cornices at top of window. These frames are well adapted for large windows and are specially designed for withstanding wind pressure.

On page 219 we give another photograph of cast iron front work two stories high for a store building. The sashes or windows in the first story are made in three sections. The upper section is stationary, while the lower sections are made to slide up and down. The sashes are counter-weighted with ball-bearing hangers and pulleys, with flexible steel wire ropes and can be easily lifted by one person. The counter weights are enclosed in a box on the inside of front. This style of store front is specially adapted for the display of goods and merchandise, as the entire front of the store is thrown open in warm weather, and in cold or stormy weather the sashes can be pulled down, thus entirely enclosing the front of the store.

We also furnish frames for single windows for office buildings or for store buildings, either of cast iron or of solid bronze.

On page 216 we show a photograph of ornamental cast iron mullions or posts on front of building with moulded cast iron sills and transoms separating the various doors and windows. These mullions are also used as supporting columns when necessary, and can be made of any required thickness.

SIEGEL-COOPER STORE, 18TH AND 19TH STREETS AND SIXTH AVENUE, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

STORE BUILDING, 16TH STREET AND SIXTH AVENUE, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

GATES, LAMPS AND FOUNTAINS.

Gates can be made of various designs, either folding, swinging or lifting. On Plate No. 71 is represented folding gates which we have furnished at the ground floor entrance of elevators in an office building. These gates are divided in the centre and slide each way, the halves being connected overhead at the back of the transom by pulleys and an endless chain so arranged that when one-half of the gate is opened the other opens at the same time automatically; in this way the entire front of the elevator car is thrown open to allow free entrance or exit of passengers. These gates are also connected by an automatic attachment on top of the car so that they can only be opened when the car is opposite the gate. These gates are made of solid bronze but we can also furnish them of wrought iron or steel either painted or electroplated in imitation of bronze. They can be used either for elevator gates or for entrance doorways.

On page 216 we show a photograph of plain folding gates made of steel, for shipping entrances

On Plates Nos. 72 and 73 are indicated designs of ornamental folding gates for private residences. These gates can be furnished either of wrought iron or of bronze. The gate shown on Plate No. 73 is made of wrought iron with hammered leaf work of the highest quality and finish, equal to the best examples of French workmanship.

On page 231 we show a sample of wrought iron stationary grille work for private residence which is

finished in "Verde Antique" of various shades of green in imitation of old copper, oxidized by exposure to the weather; this presents a very rich effect.

On Plate No. 74 we give designs of iron lamps which we have recently furnished for a building in Mexico. These lamps have beveled plate glass on six sides and can be finished either for electric light, gas or oil, and can be made of any size from 2 to 8 feet in height; they can also be furnished in solid bronze.

We also furnish lamp posts with globes at the top, either for electric light or gas, as indicated on Plate No. 75.

On this same plate we give design of a fountain, which can be furnished in any size from 8 to 30 feet in height, suitable for private gardens or for public parks. These fountains are made of cast iron, painted, or if required can be electroplated in imitation of bronze, or can be finished in "Verde Antique" in imitation of oxidized copper.

Plate No. 71.

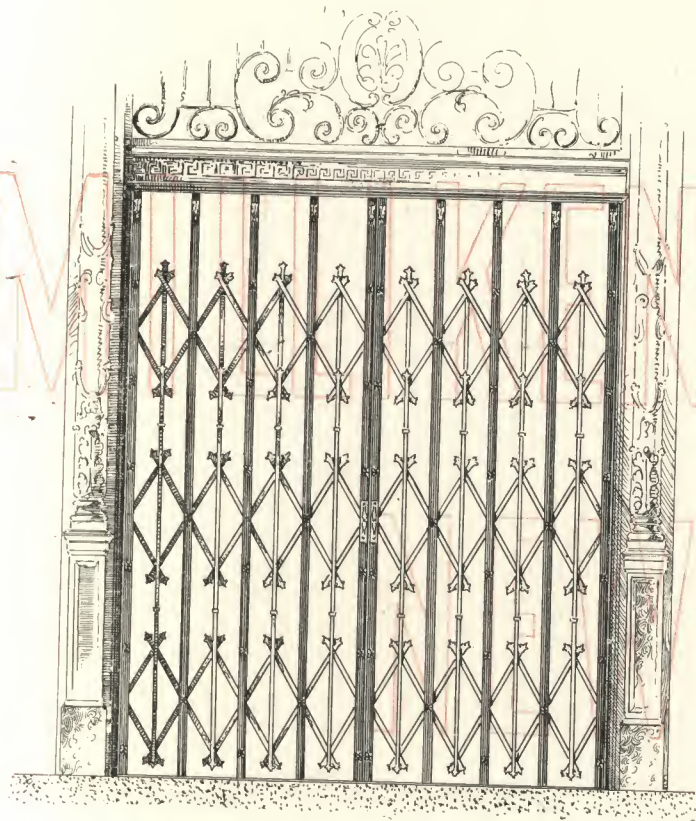


Plate No. 72.

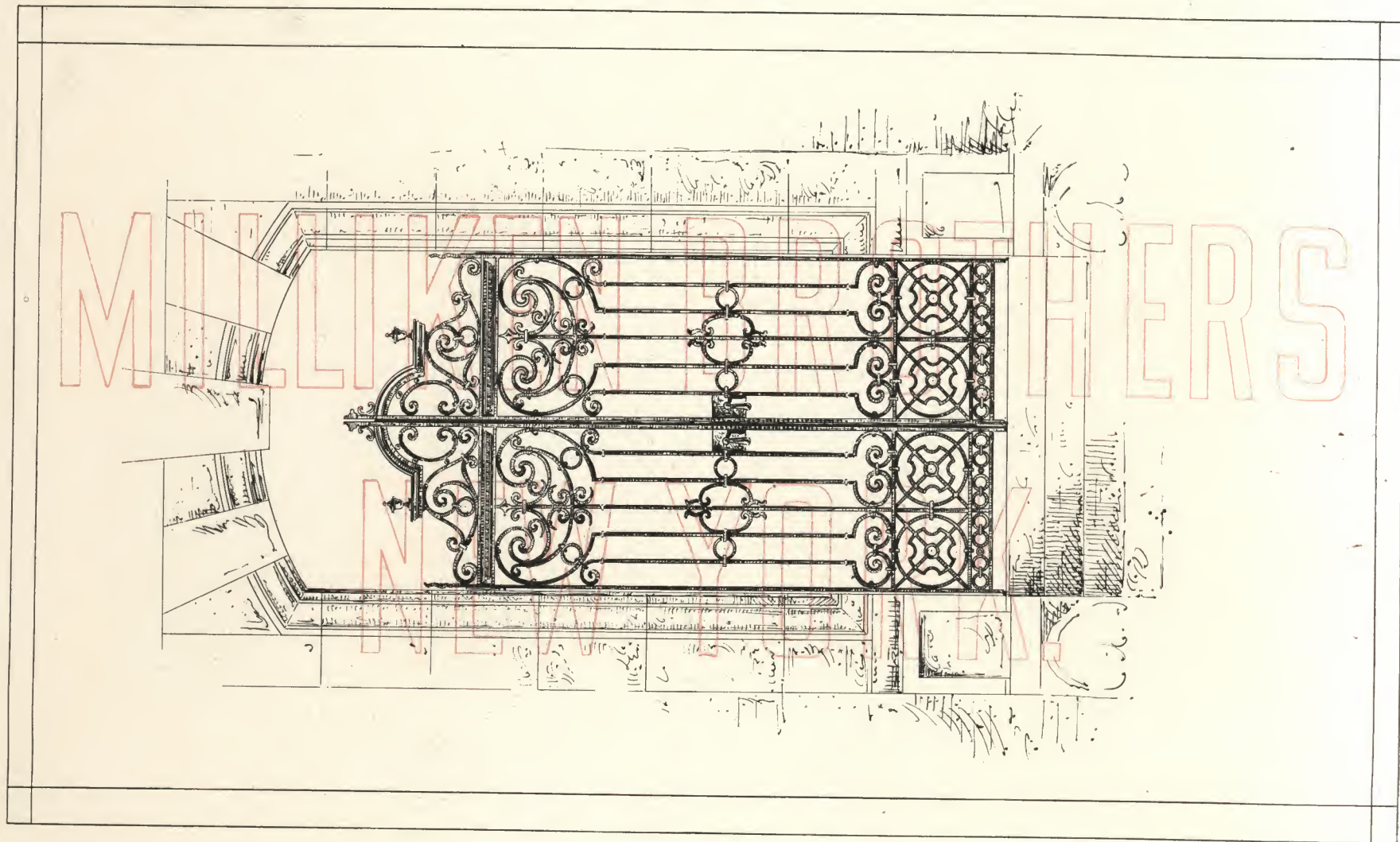


Plate No. 73.

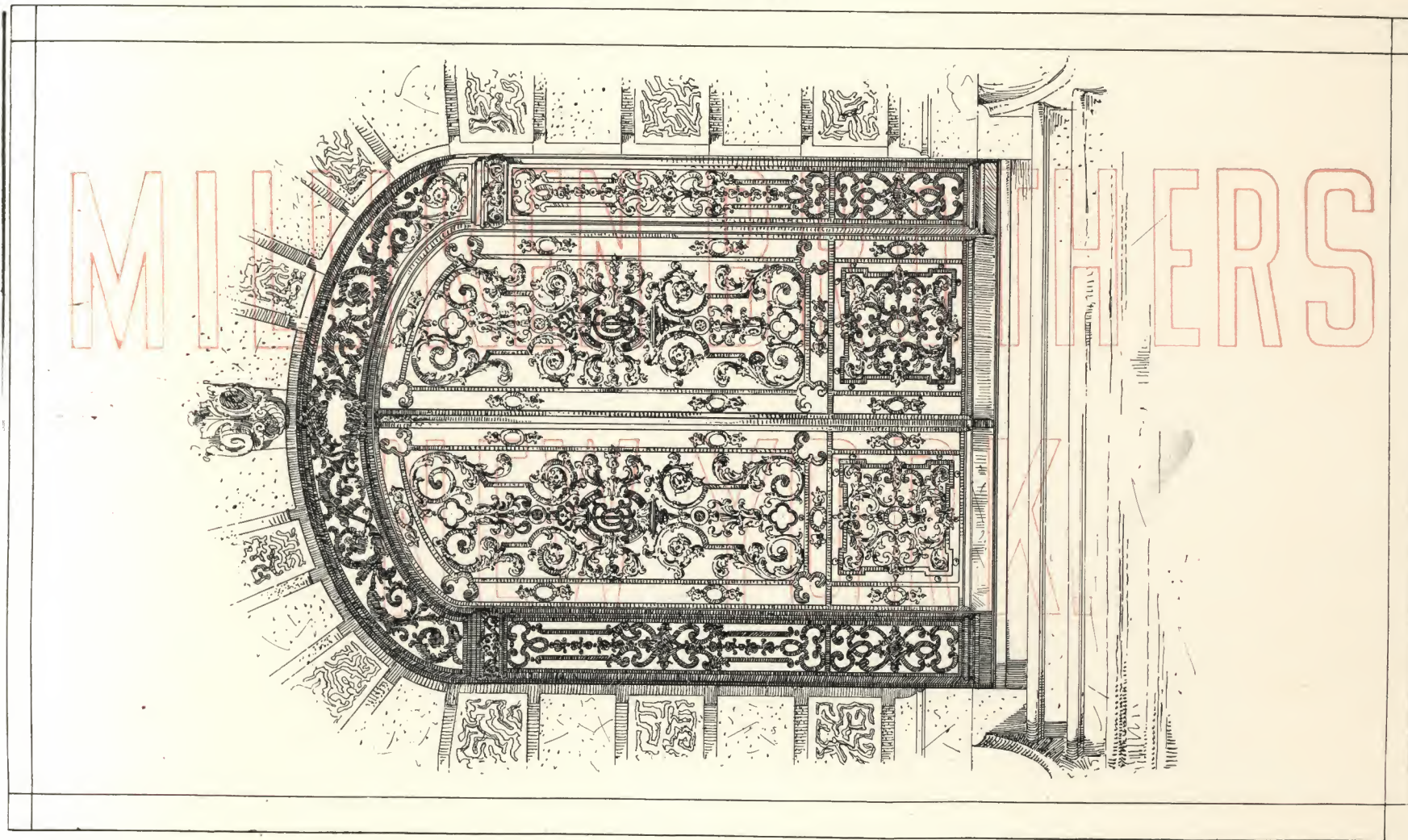


Plate No. 74.

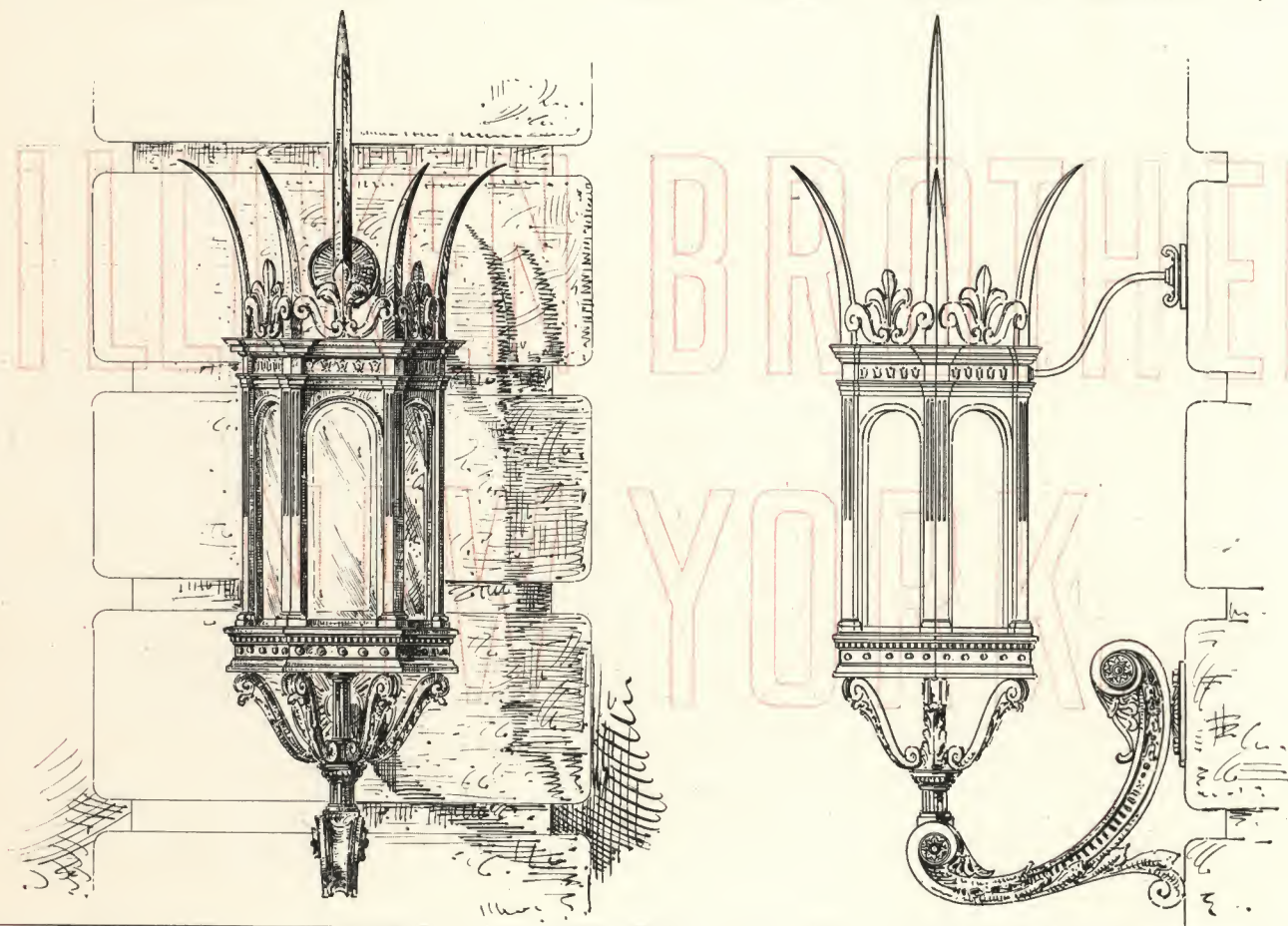
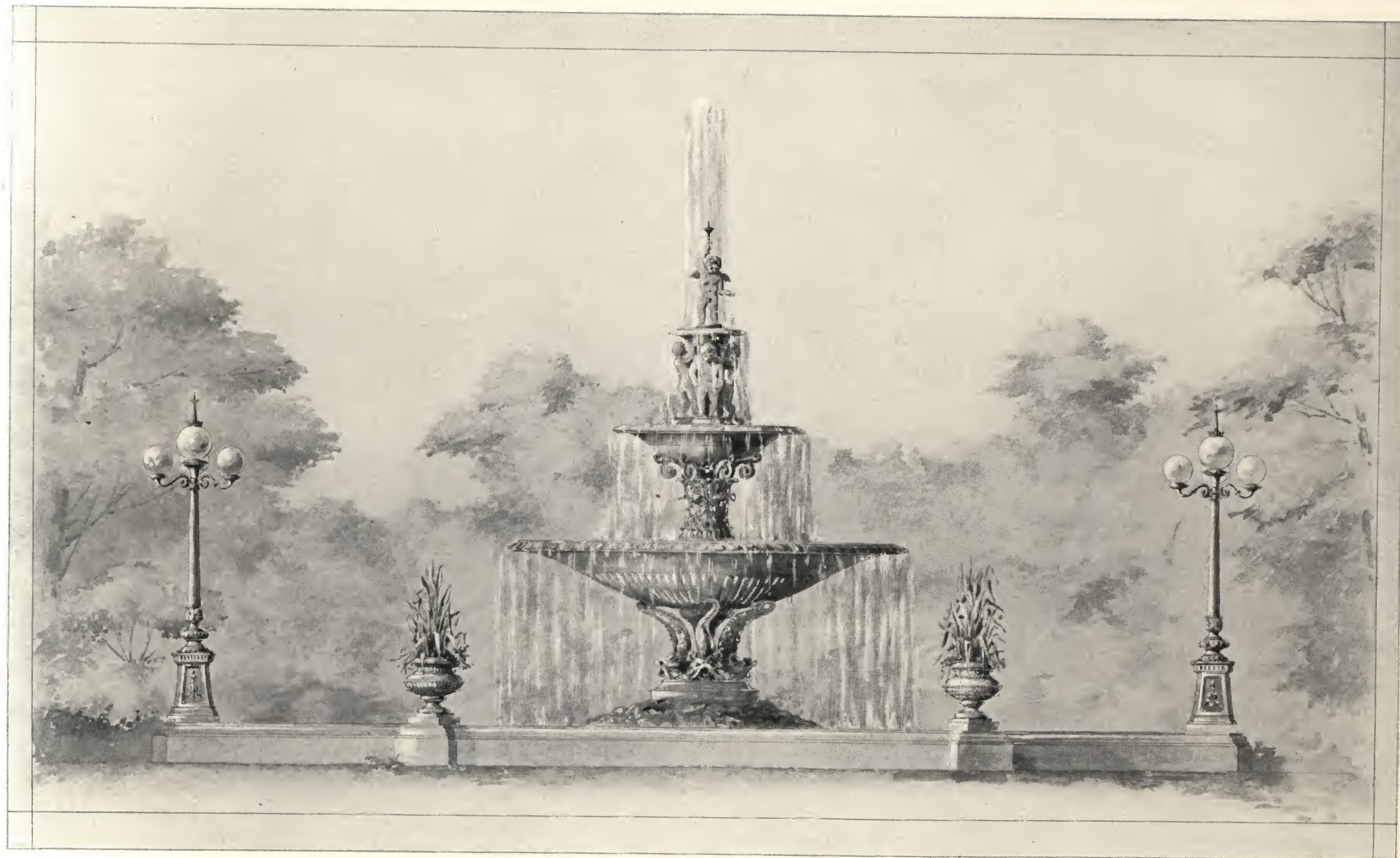


Plate No. 75.



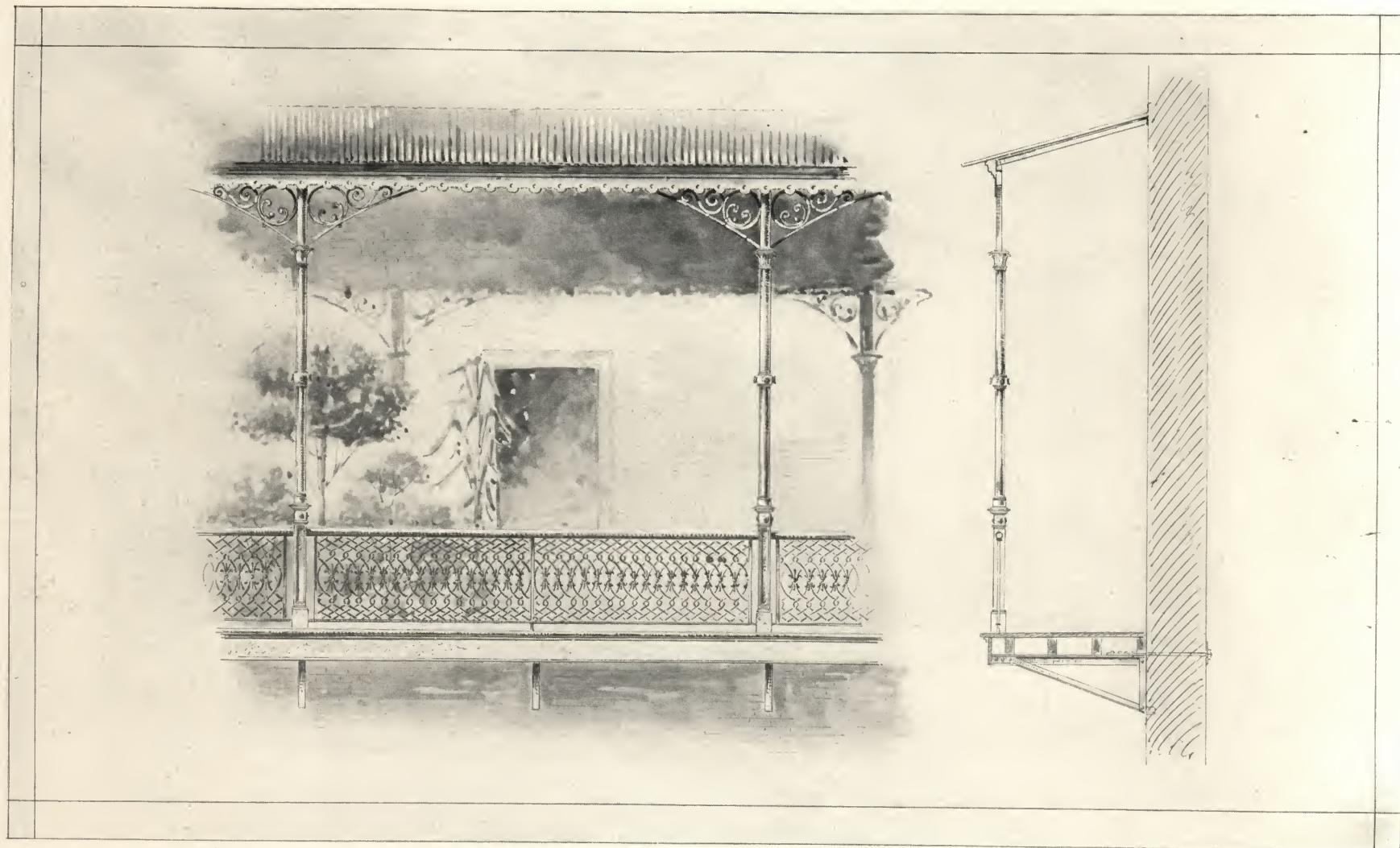
BALCONIES, PORTICOS, MARQUISES, CANOPIES AND PORTE-COCHERES.

Iron balconies of either plain or ornamental design can be furnished for the outside of private or public buildings. On Plate No. 76 we show sketch of a simple balcony with corrugated iron roof, wrought and cast iron posts, wrought iron scroll braces and cast iron railing. The iron railing can be furnished of any design and may be either of wrought or cast iron. See Plates Nos. 77, 78, 79 and 80. The floor of the balcony is shown of wood supported on wrought iron brackets bolted through the wall. The floor can be furnished of cast iron or of steel plates if desired.

On page 231 we give a photograph of a canopy or portico enclosure over stone terrace for private house. This portico has a glass roof and is supported on a wrought iron ornamental framework with hammered leaf ornaments. The cornice and roof bars supporting the glass are of copper. The glass at the side of enclosure is removable and can be taken out in summer and put back in winter. Similar canopies can be furnished for entrances to either private residences, stores or office buildings, supported on columns or brackets.

Porte-cocheres also can be furnished over driveways supported by columns, with solid roof covering instead of glass.

Plate No. 76.



NORRIE RESIDENCE, 15 EAST 84TH STREET, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

RAILINGS.

We furnish railings of various materials and designs, either of cast iron, brass or bronze. On Plates Nos. 77, 78 and 79, we show designs of plain and ornamental railings.

On Plate No. 80 we show designs of wrought iron railings furnished by us for a private house. These railings are ornamented with hammered leaf work, doubled faced, of very fine workmanship and equal to the best work of French artisans. These railings can be made of iron, electroplated in imitation of bronze or painted. A dull black finish with the tips of the leaves gilded gives a very rich and beautiful effect.

On Plate No. 81 we show design of cast iron railing for stairs executed by us ; and on pages 242, 243 and 244 wrought iron railings for stairs which are electroplated in imitation of bronze.

Pipe railings can be furnished either in bronze, brass or wrought iron, with plain or ball fittings, and if desired ornamented with scroll work. Pipes or tubes from 1 inch to $3\frac{1}{2}$ inches outside diameter for either posts or rails.

Plate No. 77.

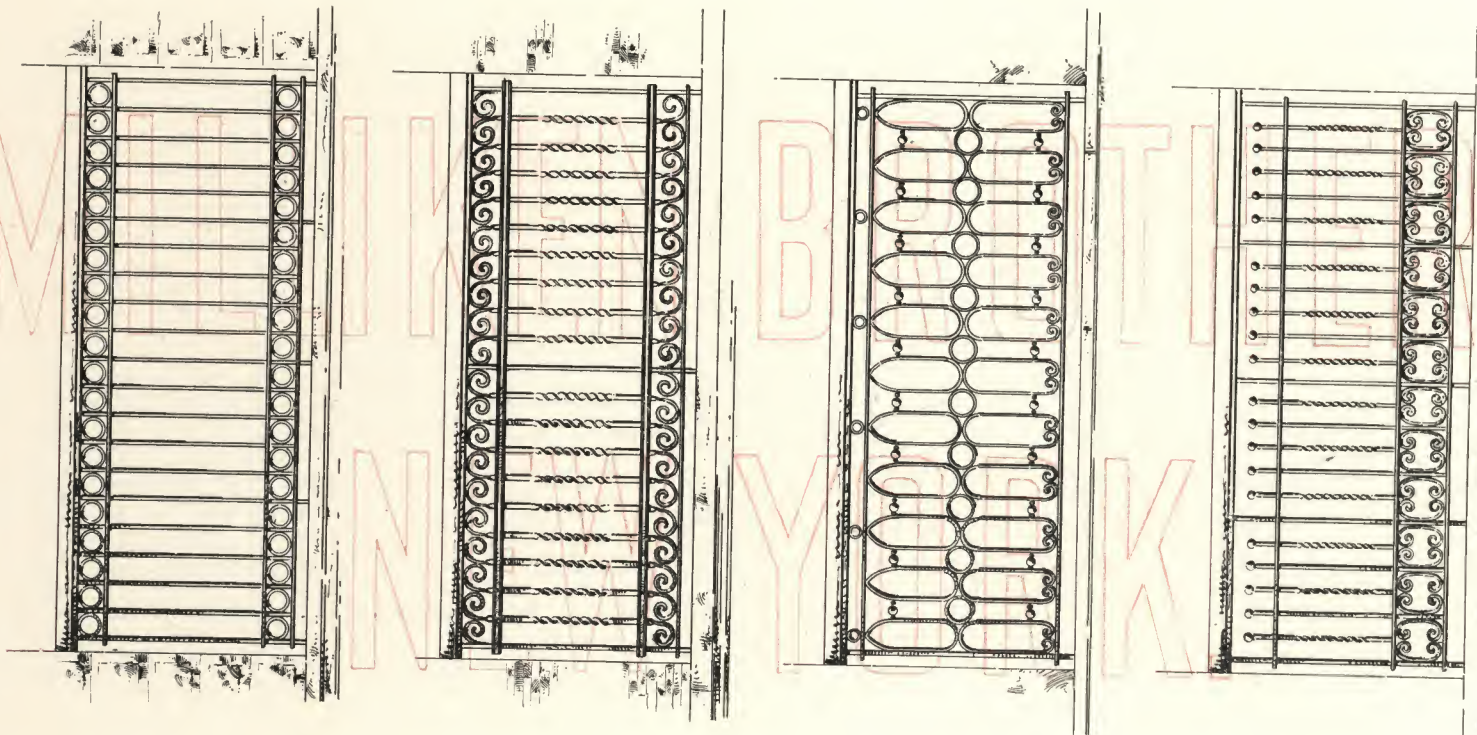


Plate No. 78.

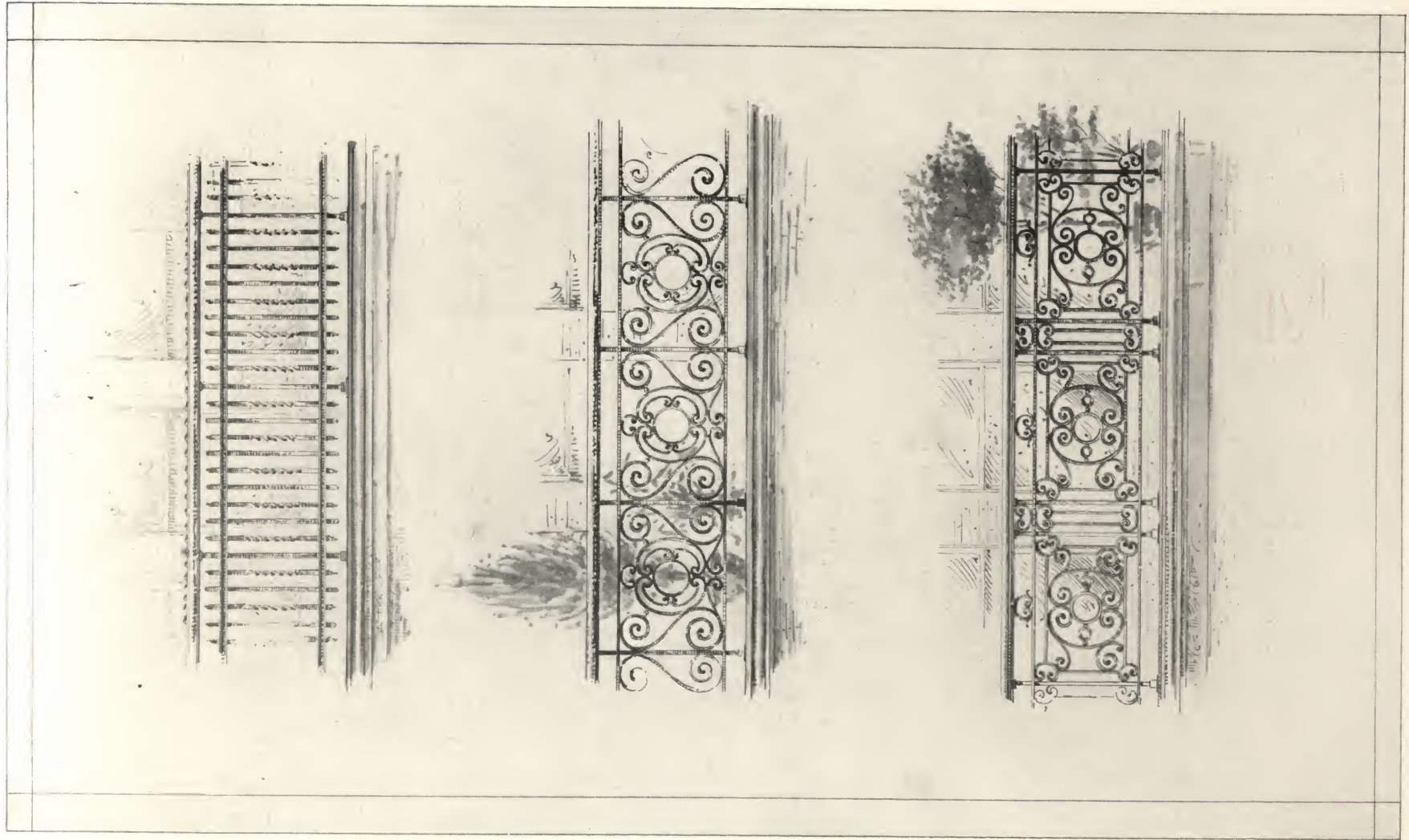
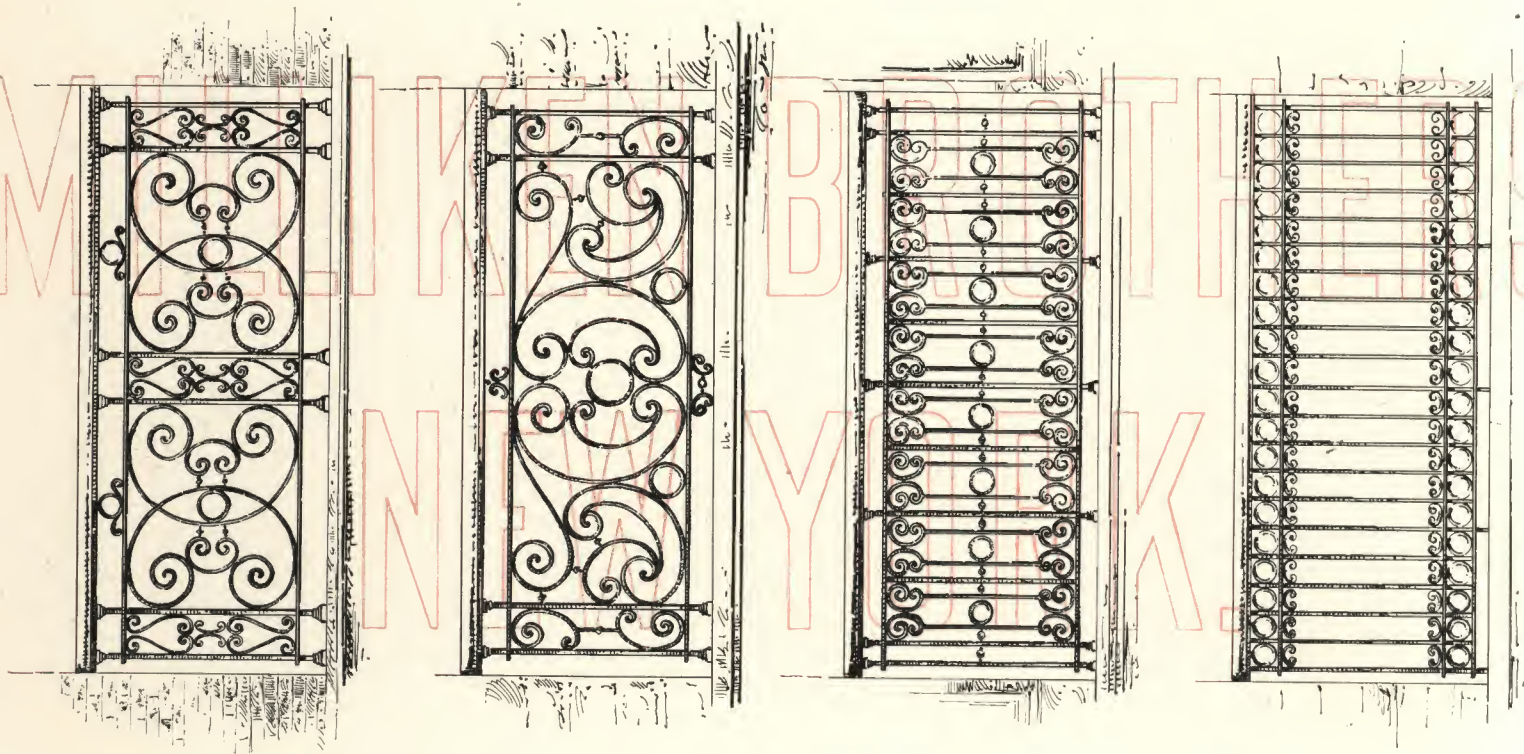
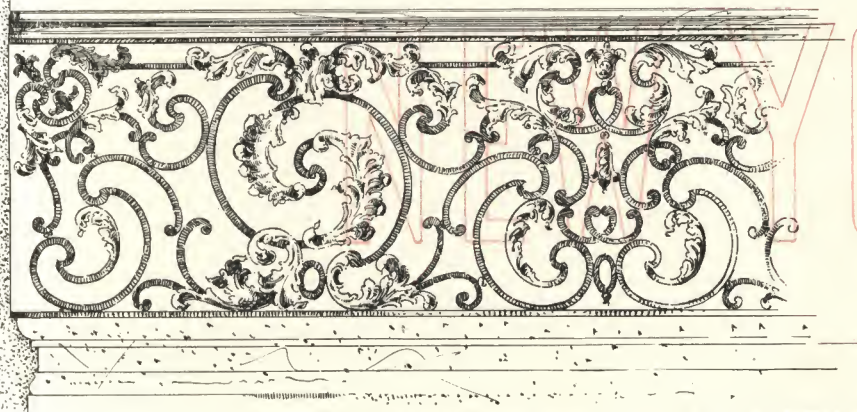
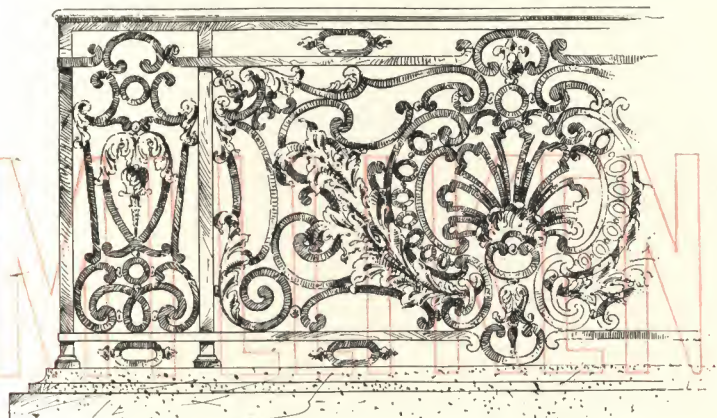


Plate No. 79.





STAIRCASES.

We furnish iron staircases of any design, either of wrought or cast iron. Circular stairs are made with a centre supporting column and are from 4 feet to 7 feet in diameter. Plain stairs can be furnished for factory or mill buildings with channel iron strings or carriages, cast iron or wooden treads, with bar iron or pipe railings.

We furnish stairs of ornamental character for stores and office buildings, also for private houses. On Plate No. 81 we show design of 36 flights of stairs which we have furnished for a large store and loft building in New York City. These stairs are built entirely of cast iron with the exception of the treads. The entire work is electroplated in imitation of bronze.

We give a photograph of office building stairs on page 244. These stairs have cast iron strings or carriages with cast iron risers, newel posts and fascias or aprons to cover over floors. The railings are entirely of wrought iron.

On page 242 we give a photograph of a staircase of special construction which we have furnished for an office building. This staircase is 13 stories in height and is constructed without any horizontal supports at the platforms or floor levels; and in this respect this staircase is unique and different from any other stair in this country. The great weight of the carriages or stair strings, with the railings and steps, in addition

to the moving load, is carried by the risers, each of which acts as a cantilever and transmits the load directly to the wall strings. These wall strings are reinforced at various points to withstand the unusual strains imposed. The curves or ramps, where the stairs turn, are built to a perfect line notwithstanding the great difficulty of moulding and casting. We give a photograph on page 243 of these same stairs, looking down from the top of the building, which gives a good illustration of the difficulties encountered in building them without any supports at floors. These stairs are electroplated in imitation of bronze.

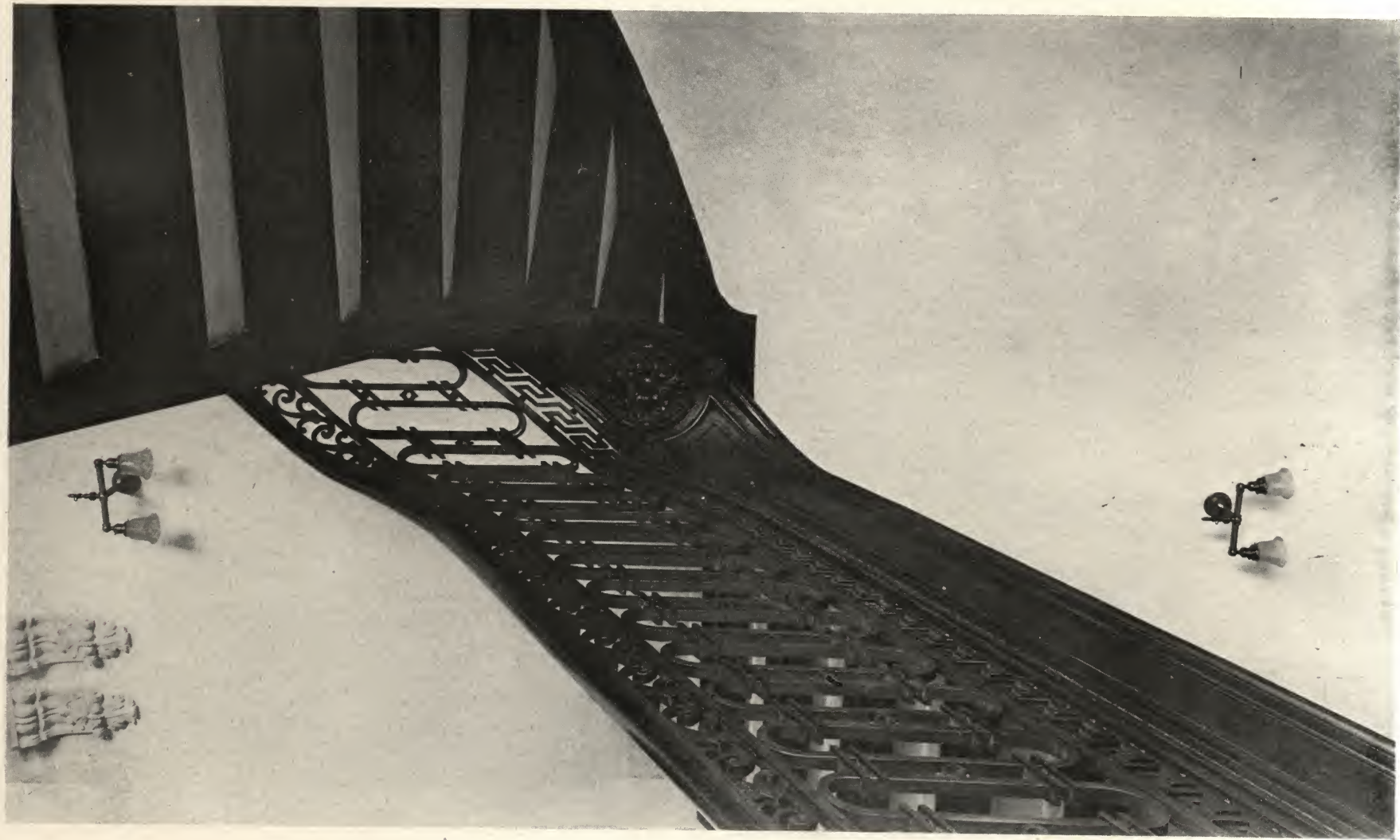
A very ornamental stair railing is shown on Plate No. 80 which we have furnished for a private residence. This stair is of wrought iron with hammered leaf ornaments, double faced.

On page 249 we show a photograph of staircase which we have built for a store building. These stairs extend around the elevator shaft thus economizing space in the store and also lessening the cost of the elevator enclosure, as the stair railing becomes a portion of the enclosure. This design is economical and yet presents an ornamental and very pleasing effect.

Plate No. 81.



BOURNE OFFICE BUILDING, 85 LIBERTY STREET, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

BOURNE OFFICE BUILDING, 85 LIBERTY STREET, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DUN BUILDING, READE STREET AND BROADWAY, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

ENCLOSURES FOR ELEVATOR SHAFTS.

Owing to the large increase of elevators in recent years, especially for office buildings, in both this country and abroad, the method of enclosing the elevator shafts so as to prevent accident has been a matter of increasing study, both as to construction and ornamentation. We have furnished many enclosures of wrought and cast iron, also of bronze.

On Plate No. 82 we show a design of enclosure for two elevators which we have furnished for a store building. The gate is in the center of shaft and is made in two parts, each half of the gate sliding automatically by means of chains and overhead pulleys. When one-half of the gate is opened the other half slides of its own accord. The base of the enclosure, up to a height of 3 feet, is built of cast iron. The grille work above is of wrought iron of a close design surmounted by an ornamental cast iron transom. The upper portion of the enclosure between the transom and ceiling, is filled with open grille work sufficiently strong to prevent anyone from falling out of the car.

We show a similar design on Plate No. 83, excepting that the gate is smaller, and only one-half of the front slides while the other half remains stationary.

We show a photograph on page 249 of an elevator enclosure in connection with a staircase for a store building, which is economical in cost as well as ornamental.

The elevator enclosure shown on page 251 is constructed with a cast iron framework, and the openings are filled with wrought iron grilles and frames backed up with ground glass, preventing any noise or draught from the shaft. The iron work of this enclosure is all electroplated in imitation of bronze, with all the high flat surfaces polished.

The enclosure shown on page 250 is built entirely of solid bronze with automatic folding gates. This enclosure, as to design and finish and the large amount of bronze used in its construction, is one of the finest ever made.

We also give a photograph of a counter screen for business offices, on page 251. This is built entirely of solid bronze with small wickets or gates suitable for banking offices, with a glass shelf projecting on the outside supported on bronze brackets. This counter screen can be furnished either of bronze, cast or wrought iron painted, or of wrought iron electroplated in imitation of bronze.

Plate No. 82.

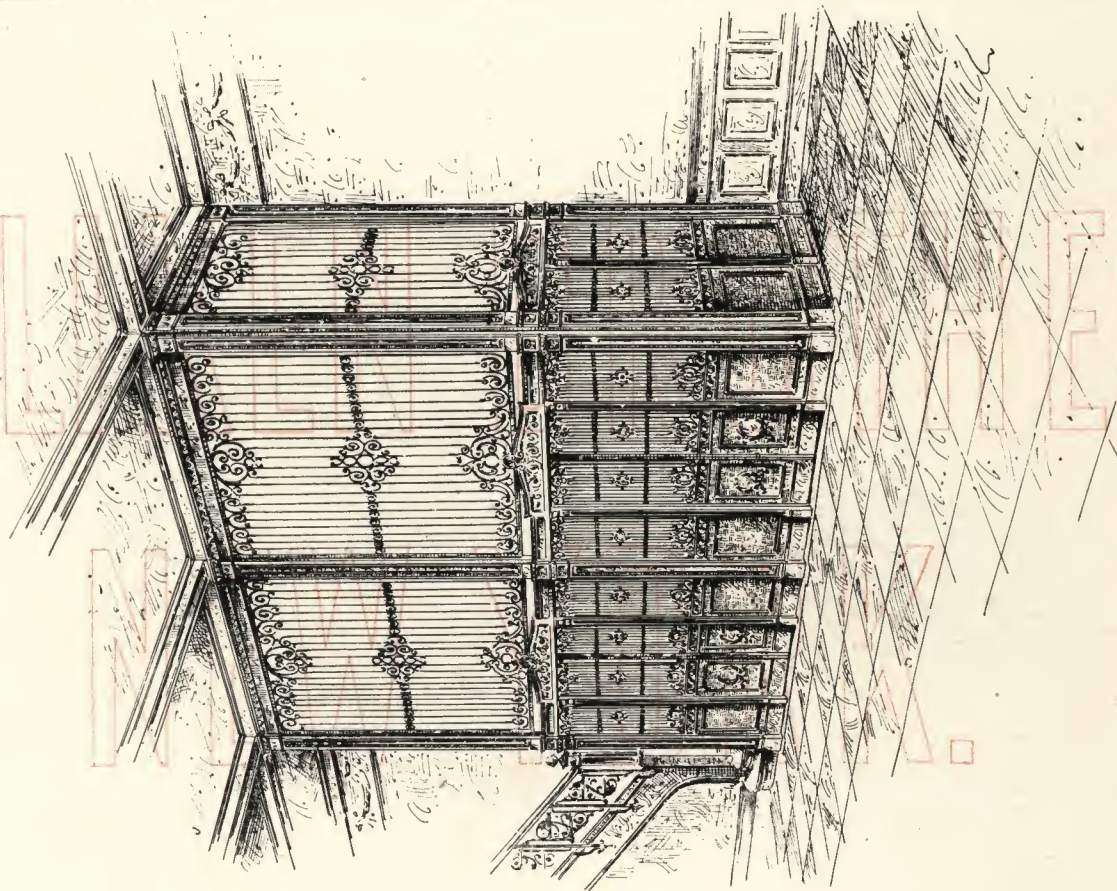
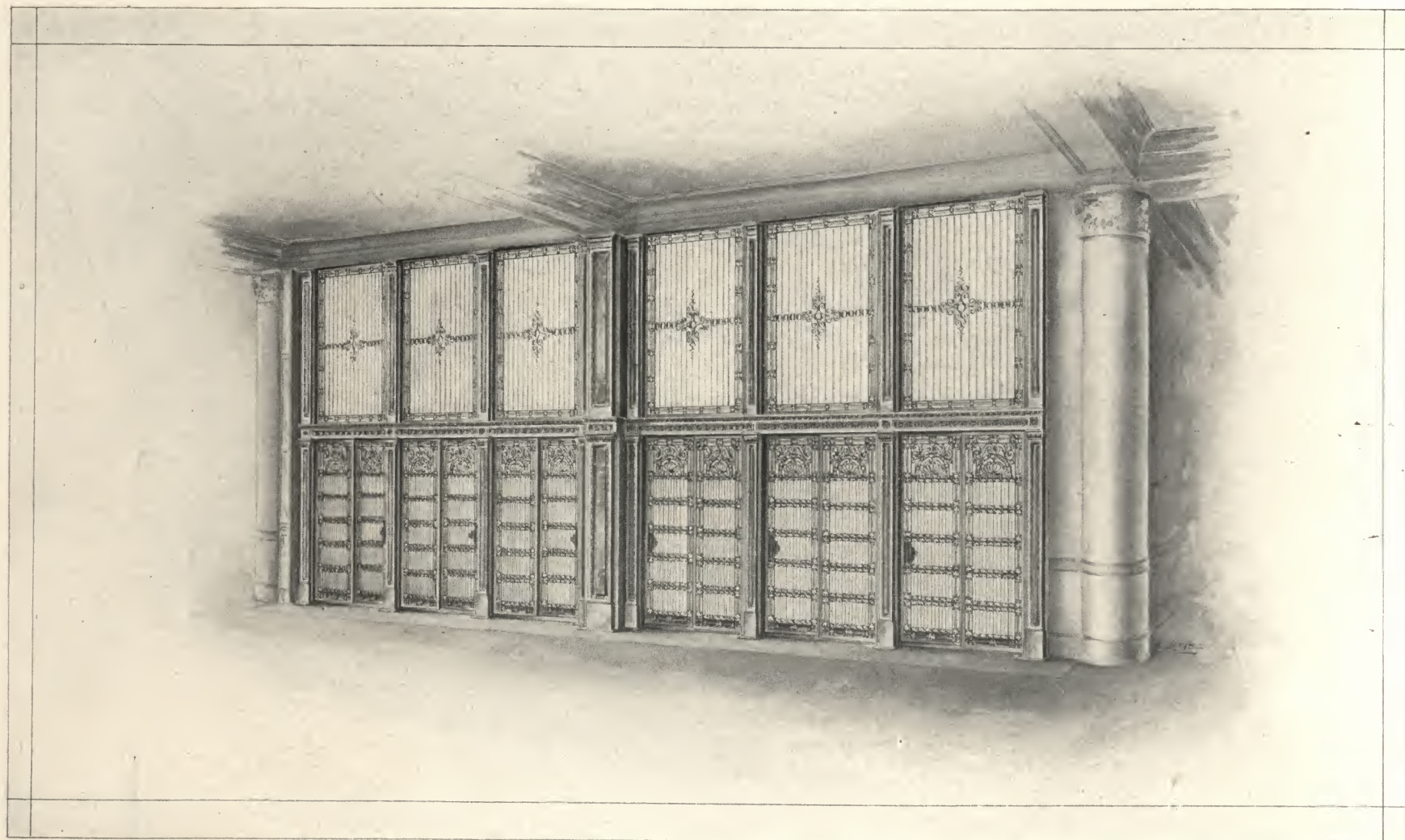


Plate No. 83.

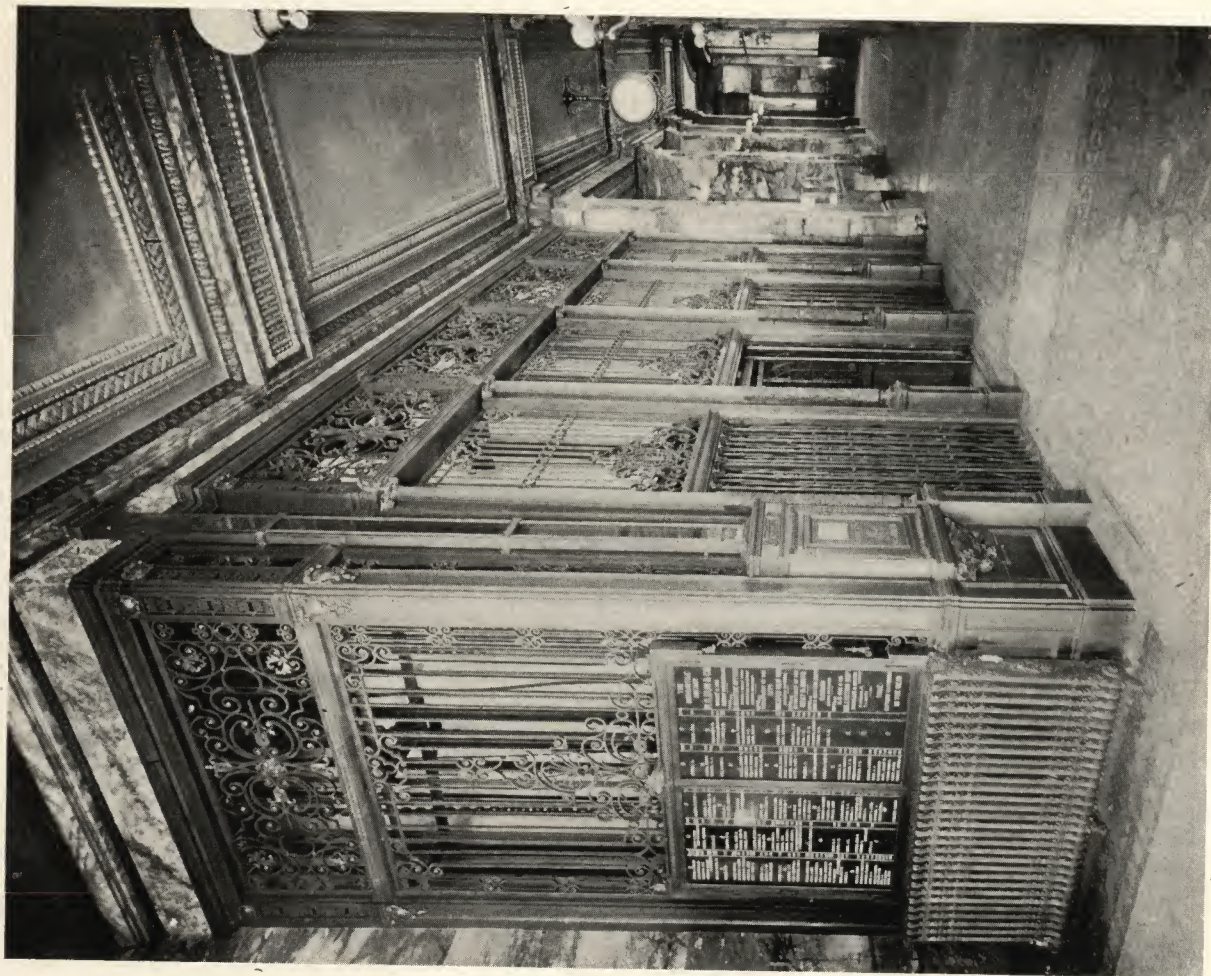


MORGENTHAU BUILDING, 19TH STREET AND SIXTH AVENUE, NEW YORK.



IRON WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DUN BUILDING, READE STREET AND BROADWAY, NEW YORK.



BRONZE WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

DUN BUILDING, READE STREET AND BROADWAY, NEW YORK.



BRONZE WORK FURNISHED AND ERECTED BY MILLIKEN BROTHERS.

ORNAMENTAL SHEET METAL WORK.

Sheet metal work of an ornamental character has come into general use in recent years, to take the place of stone or iron, for cornices, balustrades, consoles, panels, fascias, mouldings and work generally of this nature. This work can be furnished at a low cost and presents a fine architectural appearance.

We show on Plate No. 84 cornices, columns and balustrades, which are all of the purest classic style. The top story of the building, around which the columns are placed, is used as a summer roof garden and is entirely open at the sides but roofed over. In cold weather removable glass partitions are placed behind the columns and balustrades, enclosing the sides. Total height of this work is 18 feet, and it is made entirely of sheet copper supported on iron framework.

We can also furnish material of this character of galvanized iron with zinc ornaments in place of copper. We can furnish cornices of any size and of any thickness, from No. 16 to No. 28 guage, as may be required.

On Plate No. 85 is shown elevation and section of a cornice which we have furnished for a large store building in a foreign country. This cornice is 10 feet high and is made entirely of sheet copper, excepting the inside panels of the fascia, which are filled with marble slabs.

We also furnish sheet copper or galvanized iron ornamental ridging for roofs, hammered metal ceilings, casings and pediments for outside of windows, covering for bay windows, and if desired the entire front of building can be made of sheet metal with any required amount of ornaments.

Plate No. 84.

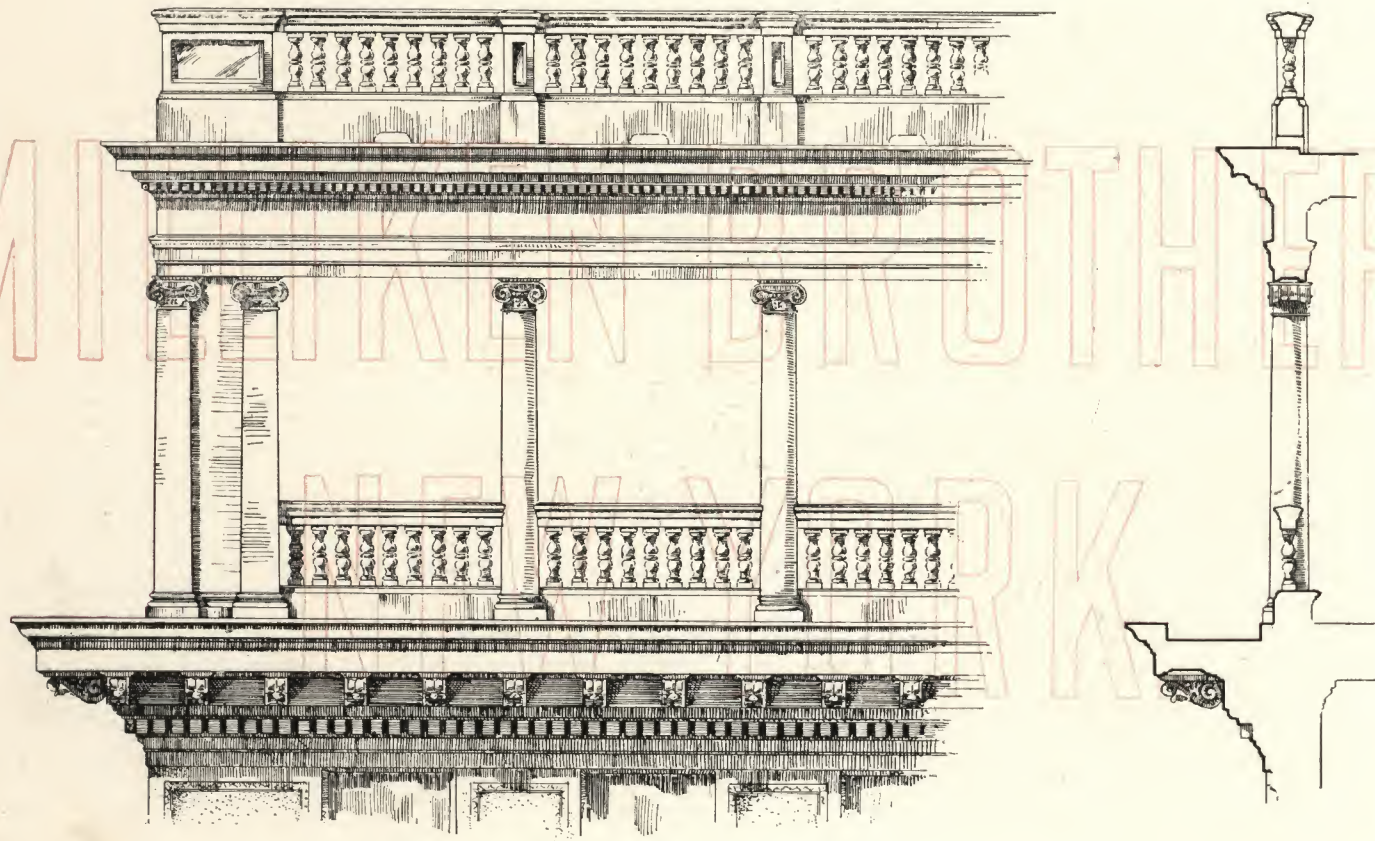
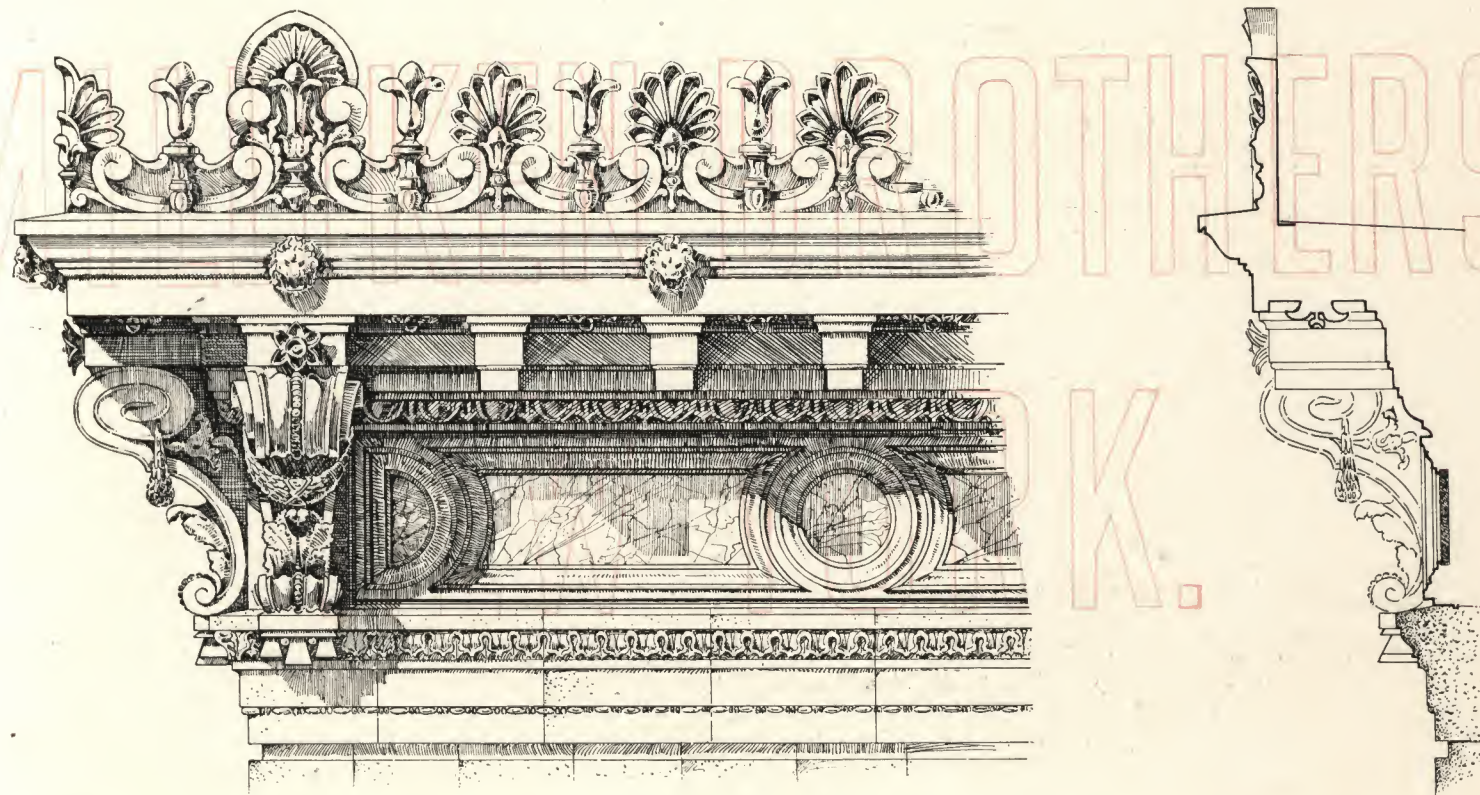


Plate No. 85.

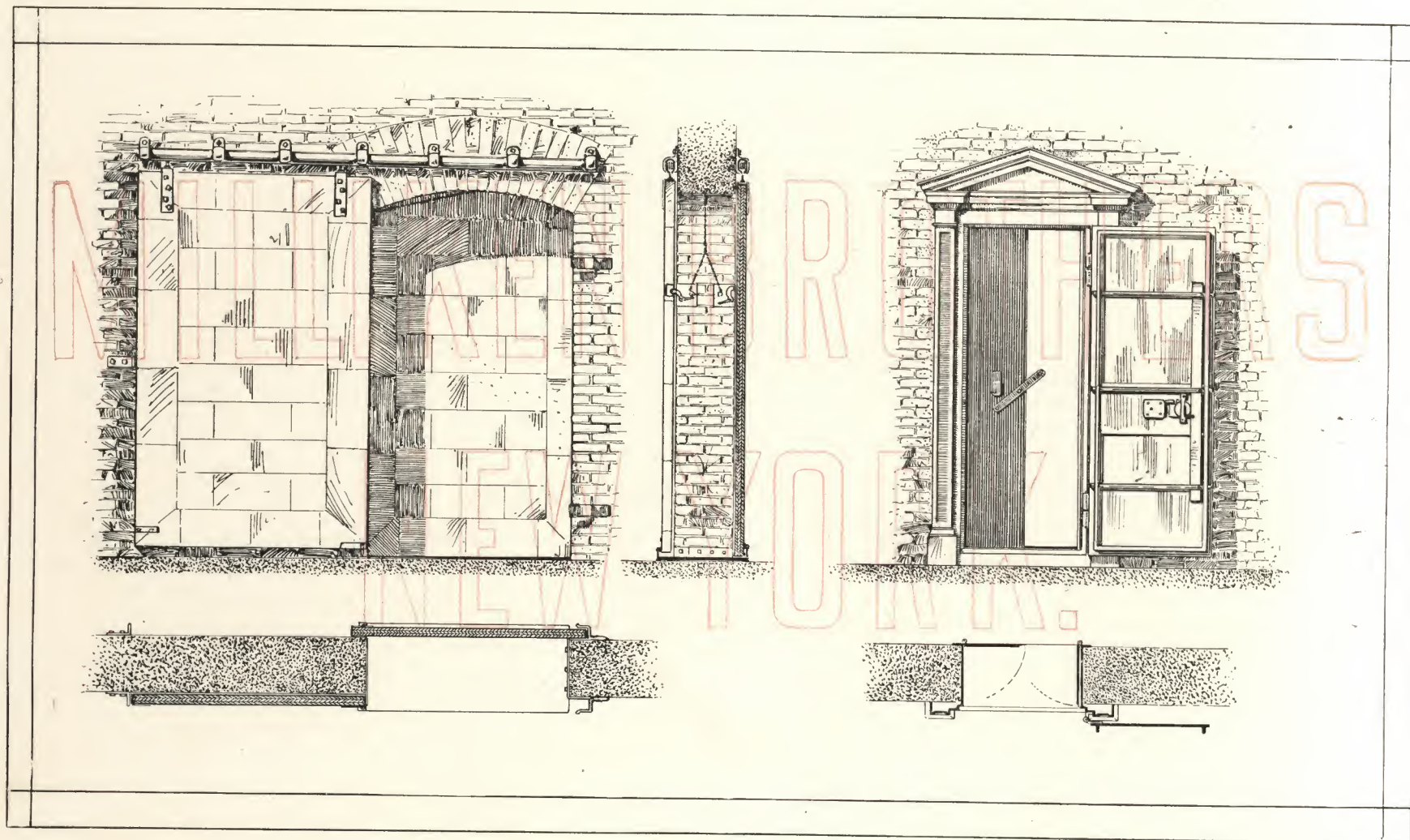


FIRE PROOF DOORS.

We furnish doors of sheet iron, with or without frames, or of wood covered with tin, galvanized iron or copper; plain or paneled, of any desired size. See Plate No. 86. These doors can be furnished with over-head tracks, fire fuses and complete self-closing attachments so that in case of fire the fuse will burn and the doors will close automatically by their own weight, the tracks being placed on a slight incline. These doors are very serviceable for factory buildings and for doorways between buildings. When the doors connect two buildings, the sills are placed 3 inches above the floor so as to prevent the water going from one building to the other, thus causing damage.

We also furnish Safe Doors, single or double, plain or ornamental, with or without combination locks. On the above Plate we show an elevation and plan of a safe door, the inner door being made in two folds and the outer door in one fold, hung on a cast iron frame. These can be furnished of any width or height desired, and the face of the outer door and frame can be moulded, decorated and painted.

Plate No. 86.



IN addition to work described and shown on the preceding pages, we furnish other material, a partial list of which is given below :

CHIMNEY CAPS, either of cast iron or steel ; plain or ornamental.

ELEVATORS, either passenger or freight, with cars, guides, ropes and machinery for same, either for hydraulic or electric power. Hand power elevators for sidewalks ; also dumb waiters.

FIRE ESCAPES of wrought iron, plain or ornamental, for store or factory buildings.

FLAG POLES of steel or wood with halliards and fittings complete, including gilded balls and braces.

GATES. Automatic wooden safety gates for front of freight elevators, counter-balanced, self-closing and operated automatically by car.

GEARING AND OPENING DEVICES for iron or wooden sashes or transoms.

GRATINGS of cast or wrought iron for sidewalks and areas ; also steel bar or wire gratings for top of elevator shafts to prevent machinery from falling down the shaft.

GUARDS, either ornamental or plain, of iron, brass or bronze, for windows and doors.

MARBLE TREADS AND PLATFORMS for staircases, either of white Italian, grey or white American.

SLATE TREADS AND PLATFORMS for staircases, either black, purple or green.

SHUTTERS for outside of windows, specially adapted for fire protection ; can be made either of sheet iron, with or without iron frames, or can be furnished of wood covered with tin.

SHUTTER EYES for building into walls to support shutters ; can be either painted or galvanized.

SADDLES OR SILLS of cast iron, brass or bronze, for entrance doors or elevator doors.

SNOW GUARDS for pitched roofs.

WHEEL GUARDS AND FENDERS for protection of driveway entrances, either solid cast iron or of wrought iron bars. Also cast iron plain or ornamental fenders or bases, 6 inches to 5 feet in height, for protection of interior columns.

WIRE GUARDS with frames, either painted or galvanized.

WOODEN SASH AND FRAMES for windows, including cords, pulleys, weights and glass; also wooden doors and frames, with hardware for same.

WOODEN HANDRAILS for staircase railings, either of oak, ash or mahogany.

CABLE CODE.

In attempting to get up a telegraphic cable code it is quite evident that it is impossible to make such a code as to allow people to order entire buildings or any and every class of material which we furnish that enters into buildings. We have therefore endeavored in the following pages to give simple requests for prices, information, and answers thereto, and also code words representing certain classes of raw material.

It is therefore understood that this code is only partially complete and is intended to be used in connection with the A B C Code Fourth Edition and Lieber's Standard Code. We have been very careful in preparing this code not to use any words that are used in the A B C Code or Lieber's Standard Code, thus avoiding any mistakes due to this cause.

Parties desiring estimates on complete iron structures will therefore be obliged to send in drawings and specifications, or send us such information as will enable us to make up drawings and specifications from which to make estimates on the work in question. At all times, however, we should be very pleased to use this code as far as possible in order to save time, and we expect from time to time to increase this code so as to cover as large a class of information as it is possible to cover in a work of this nature.

It will be noted that we have divided the code under headings. First, phrases embodying information that customers desire us to furnish them with, and immediately following that are phrases in answer to these questions. We believe that this method will help our customers in finding the correct phrases that they wish to use in cabling.

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1.—Inquiries for Prices, Deliveries, etc.

Code Word.	
<i>Labor</i>	Telegraph lowest net price f. o. b. cars or vessel N. Y. Harbor.
<i>Lace</i>	Telegraph lowest net price and earliest time of delivery f. o. b. cars or vessel N. Y. Harbor.
<i>Lack</i>	At what price will you furnish from stock——
<i>Laconical</i>	Can you reduce your price of——
<i>Laconism</i>	Can you supply additional material at same price?
<i>Lactine</i>	At what price will you supply additional material?
<i>Lading</i>	When could you deliver f. o. b. cars or vessel N. Y. Harbor?
<i>Ladle</i>	Can you make earlier delivery?
<i>Lady</i>	Delivery must be made promptly.
<i>Laird</i>	Delivery may be made at your convenience.
<i>Lamb</i>	How long will you hold price open?
<i>Lame</i>	We cannot allow you to enter order unless you will ship by——
<i>Laminate</i>	We cannot allow you to enter order unless you will reduce your price. We will give you until—— to ship.
<i>Lamp</i>	

Code Word.

Landau
Landloper
Landrel
Languor
Lap
Lapel
Larboard
Larch
Large
Lariat

Larrup

Lastly
Lately
Latent

Latin

Latitude
Latrant
Latterly
Laugh
Launch

ANSWERS TO No. 1.

Our lowest price f. o. b. cars or vessel N. Y. Harbor is——
 In accordance with your letter of——
 In accordance with your telegram of——
 We can deliver complete in——
 We can furnish complete from stock.
 We cannot furnish from stock.
 We cannot reduce our price of——
 We will reduce our price——
 We cannot make better delivery.
 We cannot make estimate from information sent.
 We will supply additional material at same price.
 We will supply additional material at——
 We cannot supply the material you ask for.
 We do not make the sizes you ask for. Can furnish——
 Cannot hold price open. Must accept immediately by wire.
 Will hold price open for——

2.—Acceptance of our Quotations, etc.

Code Word.

<i>Laura</i>	We accept your quotation of——
<i>Lava</i>	We cannot accept your quotation of——
<i>Laveer</i>	Can accept your quotation, if you will deliver in——
<i>Lawsuit</i>	Time of delivery is satisfactory, but prices are too high.
<i>Lawyer</i>	Prices are too high. Can offer you——
<i>Lazily</i>	
<i>Lazy</i>	
<i>Leak</i>	
<i>Leanly</i>	

ANSWERS TO No. 2.

<i>Leap</i>	We accept your order on the terms stated.
<i>Learning</i>	We cannot accept your order on the terms stated.
<i>Leasing</i>	We accept your offer of——
<i>Leaving</i>	We cannot accept your offer of——
<i>Lection</i>	We cannot execute your order until further details are received.
<i>Leeward</i>	
<i>Left</i>	
<i>Legal</i>	
<i>Legality</i>	

3.—Terms of Payment, etc.

Code Word.

<i>Legation</i>	What terms of payment will you accept?
<i>Lemon</i>	Will arrange satisfactory terms of payment.
<i>Lesion</i>	Net cash on delivery of shipping papers in New York City.
<i>Lethal</i>	Arrange bankers' credit or letter of credit on New York.
<i>Lethean</i>	Advise us name of your agents here who will make payments.
<i>Leveler</i>	Must have payments arranged before we execute your order.
<i>Lever</i>	Your terms of payment are satisfactory.
<i>Levity</i>	Your terms of payment are not satisfactory.
<i>Lexical</i>	
<i>Liablc</i>	
<i>Liability</i>	
<i>Liar</i>	

4.—Marking, Freight and Shipping Instructions.

Code Word.

<i>Libel</i>	Send immediately full marks for material.
<i>Libelous</i>	Send immediately full shipping instructions.
<i>Liberal</i>	Send us name of your shipping agents.
<i>Liberalism</i>	How shall we ship?
<i>Libertine</i>	Are shipping instructions we have correct?
<i>Liberty</i>	Send immediately full marks and shipping instructions.
<i>Libratory</i>	Wire us immediately full marks and shipping instructions. Must have them to make shipment.

Licentious

ANSWERS TO No. 4.

<i>Lichen</i>	Mark material as follows.
<i>Lickerish</i>	Ship material as follows.
<i>Licorice</i>	Our shipping agents are——
<i>Lictor</i>	Shipping instructions will be given you by——
<i>Lifeboat</i>	Shipping instructions will be given you later.
<i>Lighter</i>	Shipping instructions you have are correct.
<i>Lignite</i>	Mark the goods as follows——, and ship them via——

Likelihood

Likewise

5.—Inquiries about Shipments of Orders.

Code Word.

<i>Liking</i>	Have you shipped order——
<i>Lily</i>	When will you ship order——
<i>Limb</i>	When will you ship balance of order?
<i>Lime</i>	When will you make next shipment?
<i>Limitable</i>	Can you ship order from stock?
<i>Limpsey</i>	
<i>Linden</i>	

ANSWERS TO No. 5.

<i>Link</i>	We have shipped order complete.
<i>Linger</i>	We shipped order complete——
<i>Lingual</i>	We will ship order complete——
<i>Linguist</i>	We will ship balance of order——
<i>Lining</i>	We will make next shipment——
<i>Linnet</i>	Cannot say when we can make shipment.
<i>Linseed</i>	Cannot ship order from stock.
<i>Linstock</i>	Can ship order from stock.
<i>Lion</i>	Can ship from stock in following sizes.
<i>Lithe</i>	
<i>Litigant</i>	

6.—Shipments delayed—Pieces Lost.

Code Word.	
<i>Litigate</i>	Shipment of ——— not received.
<i>Litinus</i>	What has delayed shipment of ———
<i>Lively</i>	Trace last shipment.
<i>Livid</i>	Shipment of ——— lost. Please duplicate.
<i>Living</i>	———pieces lost on shipment of ———
<i>Lizard</i>	Please duplicate pieces marked ———
<i>Loaf</i>	
<i>Loadstone</i>	

ANSWERS TO No. 6.

<i>Local</i>	We will trace shipment ———
<i>Logical</i>	We do not know what has delayed shipment ———
<i>Logwood</i>	We will duplicate shipment immediately.
<i>Loiterer</i>	We will duplicate lost pieces immediately.
<i>Lombard</i>	We cannot duplicate lost pieces.
<i>Longitude</i>	Send marks of lost pieces and date of shipment.
<i>Longwise</i>	
<i>Loom</i>	

7.—Changing, Suspending and Canceling Orders.

<i>Loosely</i>	Can we make change in order?
<i>Lovable</i>	Can we change size(s) of material?
<i>Loudly</i>	Change necessary in order.

Code Word.

<i>Lower</i>	Change necessary in size of building.
<i>Lowermost</i>	Order entirely changed. Suspend all work.
<i>Loyal</i>	Order slightly changed. Await further information.
<i>Lubricous</i>	Suspend all work on order.
<i>Lucifer</i>	Suspend work until new details are received.
<i>Lucky</i>	Cancel order of ———
<i>Luff</i>	Continue work on order.
<i>Luggage</i>	Change will not be made.
<i>Lugger</i>	
<i>Lull</i>	

ANSWERS TO No. 7.

<i>Lump</i>	We cannot make change in order.
<i>Lunacy</i>	We can make change in order.
<i>Lunation</i>	We cannot make change without additional expense.
<i>Lunch</i>	We can make change without expense.
<i>Lung</i>	Material cut. Too late to make change.
<i>Lure</i>	Have suspended work on order.
<i>Lusory</i>	Have suspended work awaiting new details.
<i>Lyceum</i>	Have canceled order.
<i>Lye</i>	Cannot cancel order.
<i>Lynx</i>	Have continued work on order.
<i>Lyrical</i>	

8.—Names of Articles, Phrases, etc.

Code Word.	
<i>Nadir</i>	Bronze work electroplated.
<i>Naivete</i>	Bronze work solid.
<i>Naked</i>	"Knocked down" for shipment.
<i>Natant</i>	Milliken Patent floor construction.
<i>Naval</i>	Ornamental iron work.
<i>Navy</i>	Painted one shop coat.
<i>Nazarite</i>	Riveted steel girders.
<i>Neap</i>	Riveted steel trusses.
<i>Necessary</i>	Rolling steel shutters.
<i>Nectarial</i>	Sheet iron No. 10.
<i>Needful</i>	Sheet iron No. 12.
<i>Negotiable</i>	Sheet iron No. 14.
<i>Negus</i>	Sheet iron No. 16.
<i>Neither</i>	Sheet iron No. 18.
<i>Nephew</i>	Sheet iron No. 20.
<i>Neuter</i>	Sheet iron No. 22.
<i>Newfangled</i>	Sheet iron No. 24.
<i>Newspaper</i>	Sheet iron No. 26.
<i>Nighness</i>	Sheet iron No. 28.
<i>Nightly</i>	Corrugations 1 1/4 inches wide.

Code Word.	
<i>Nitrate</i>	Corrugations 2 1/2 inches wide.
<i>Nocuous</i>	Corrugations 3 inches wide.
<i>Noggin</i>	Corrugations 5 inches wide.
<i>Nomad</i>	Galvanized—not painted.
<i>Nonelect</i>	Galvanized and painted.
<i>Nothing</i>	Black—not painted.
<i>Nothurt</i>	Black and painted.
<i>Notional</i>	Smoke stack self supporting.
<i>Novel</i>	Smoke stack guyed.
<i>Numerous</i>	Structural steel work.
<i>Nun</i>	
<i>Nut</i>	
<i>Nutria</i>	
<i>Nymph</i>	
<i>Oak</i>	
<i>Oar</i>	
<i>Oats</i>	
<i>Oblige</i>	
<i>Obsequious</i>	
<i>Obtainable</i>	

Steel Angles.

EQUAL LEGS.

Code Word.	Size in inches.	Size in millimetres.
<i>Aback</i>	6 x 6	152.39 x 152.39
<i>Abacus</i>	5 x 5	126.99 x 126.99
<i>Abaft</i>	4 x 4	101.59 x 101.59
<i>Abasing</i>	3½ x 3½	88.89 x 88.89
<i>Abatement</i>	3 x 3	76.19 x 76.19
<i>Abbetor</i>	2½ x 2½	63.49 x 63.49
<i>Abolish</i>	2¼ x 2¼	57.14 x 57.14
<i>Above</i>	2 x 2	50.79 x 50.79
<i>Abreast</i>	1¾ x 1¾	44.44 x 44.44
<i>Absence</i>	1½ x 1½	38.09 x 38.09
<i>Abundant</i>	1¼ x 1¼	31.74 x 31.74
<i>Abuse</i>	1 x 1	25.4 x 25.4

UNEQUAL LEGS.

Code Word.	Size in inches.	Size in millimetres.
<i>Adaptable</i>	7 x 3½	177.79 x 88.89
<i>Adjacent</i>	6 x 4	152.39 x 101.59
<i>Adjoin</i>	6 x 3½	152.39 x 88.89
<i>Adjutor</i>	5 x 3½	126.99 x 88.89
<i>Admissible</i>	5 x 3	126.99 x 76.19
<i>Adobelt</i>	4 x 3	101.59 x 76.19
<i>Adopt</i>	3½ x 3	88.89 x 76.19
<i>Adoption</i>	3½ x 2½	88.89 x 63.49
<i>Advance</i>	3 x 2½	76.19 x 63.49
<i>Advantage</i>	3 x 2	76.19 x 50.79
<i>Advisably</i>	2½ x 2	63.49 x 50.79
<i>Affix</i>	2 x 1½	50.79 x 38.09

See table for thickness farther on.

Steel I Beams.

Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Baby</i>	24	100	609.58	148.82
<i>Bacon</i>	24	95	609.58	141.38
<i>Bad</i>	24	90	609.58	133.93
<i>Baggage</i>	24	85	609.58	126.49
<i>Bagniol</i>	24	80	609.58	119.05
<i>Bailable</i>	20	100	507.99	148.82
<i>Bailee</i>	20	95	507.99	141.38
<i>Bailing</i>	20	90	507.99	133.93
<i>Bakeman</i>	20	85	507.99	126.49
<i>Bald</i>	20	80	507.99	119.05
<i>Baldrick</i>	20	75	507.99	111.61
<i>Ball</i>	20	70	507.99	104.17
<i>Ballister</i>	20	65	507.99	96.73
<i>Balloon</i>	18	70	457.19	104.17
<i>Ballotry</i>	18	65	457.19	96.73
<i>Bamboo</i>	18	60	457.19	89.29
<i>Bambust</i>	18	55	457.19	81.85
<i>Banana</i>	15	100	380.99	148.82
<i>Bandogert</i>	15	95	380.99	141.38
<i>Bandoling</i>	15	90	380.99	133.93
<i>Bang</i>	15	85	380.99	126.49
<i>Bankable</i>	15	80	380.99	119.05
<i>Bankbook</i>	15	75	380.99	111.61

Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Bans</i>	15	70	380.99	104.17
<i>Barberied</i>	15	65	380.99	96.73
<i>Barefaced</i>	15	60	380.99	89.29
<i>Barge</i>	15	55	380.99	81.85
<i>Bark</i>	15	50	380.99	74.41
<i>Barley</i>	15	45	380.99	66.96
<i>Barleybarn</i>	15	40	380.99	62.50
<i>Barmy</i>	12	55	304.79	81.85
<i>Barn</i>	12	50	304.79	74.41
<i>Barouche</i>	12	45	304.79	66.96
<i>Barrel</i>	12	40	304.79	59.52
<i>Barren</i>	12	35	304.79	52.08
<i>Basesel</i>	12	31.5	304.79	46.87
<i>Bassoon</i>	10	40	253.99	59.52
<i>Bastiled</i>	10	35	253.99	52.08
<i>Bateau</i>	10	30	253.99	44.64
<i>Bayou</i>	10	25	253.99	37.20
<i>Beautifiser</i>	9	35	228.59	52.08
<i>Became</i>	9	30	228.59	44.64
<i>Because</i>	9	25	228.59	37.20
<i>Bed</i>	9	21	228.59	31.25
<i>Bedazzer</i>	8	25.5	203.19	37.94
<i>Bedfellow</i>	8	23	203.19	34.22

Steel I Beams—Continued.

Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.	Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Bedim</i>	8	20.5	203.19	30.50	<i>Behalf</i>	5	12.25	126.99	18.23
<i>Bedraggle</i>	8	18	203.19	26.78	<i>Belhanger</i>	5	9.75	126.99	14.51
<i>Bedrest</i>	7	20	177.79	29.76	<i>Bell</i>	4	10.5	101.59	15.62
<i>Bedroom</i>	7	17.5	177.79	26.04	<i>Belong</i>	4	9.5	101.59	14.13
<i>Beef</i>	7	15	177.79	22.32	<i>Below</i>	4	8.5	101.59	12.64
<i>Beeves</i>	6	17.25	152.39	25.67	<i>Bemoned</i>	4	7.5	101.59	11.16
<i>Befall</i>	6	14.75	152.39	21.95	<i>Berating</i>	3	7.5	76.19	11.16
<i>Before</i>	6	12.25	152.39	18.23	<i>Berry</i>	3	6.5	76.19	9.67
<i>Begin</i>	5	14.75	126.99	21.95	<i>Berth</i>	3	5.5	76.19	8.18

Steel Bulb Angles.

<i>Beset</i>	10	26.5	253.99	39.43	<i>Bespeak</i>	6	17.20	152.39	25.59
<i>Besettle</i>	9	21.8	228.59	32.44	<i>Bespread</i>	6	13.75	152.39	20.45
<i>Besides</i>	8	19.23	203.19	28.6	<i>Betake</i>	6	12.30	152.39	18.3
<i>Bespanment</i>	7	18.25	177.79	27.15	<i>Bethink</i>	5	10.0	126.99	14.88

Steel Zee Bars.

	Depth in inches.	Depth in millimetres.		Depth in inches.	Depth in millimetres.
<i>Betimes</i>	6	152.39	<i>Between</i>	4	101.59
<i>Betterment</i>	5	126.99	<i>Bibulistic</i>	3	76.19

See table for thickness farther on.

Steel Deck Beams.

Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.	Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Dale</i>	10	35.7	253.99	53.13	<i>Data</i>	8	20.15	203.19	30.0
<i>Danger</i>	10	27.23	253.99	40.6	<i>Daub</i>	7	23.46	177.79	34.8
<i>Dare</i>	9	30.0	228.59	44.6	<i>Daunt</i>	7	18.11	177.79	26.9
<i>Darnel</i>	9	26.0	228.59	38.7	<i>Davit</i>	6	18.36	152.39	27.3
<i>Dash</i>	8	24.48	203.19	36.4	<i>Dead</i>	6	15.30	152.39	22.7

Phoenix Columns.

<i>Gaily</i>	4-A Segments.	<i>Gambling</i>	4-C Segments.
<i>Gallic</i>	4-B ₁ Segments.	<i>Gamboge</i>	6-E Segments.
<i>Galoche</i>	4-B ₂ Segments.	<i>Gamut</i>	8-G Segments.

See table for thickness farther on.

Steel Channels.

	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.		Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Cabal</i>	15	55	380.99	81.85	<i>Cachou</i>	15	33	380.99	49.11
<i>Cabin</i>	15	50	380.99	74.41	<i>Calash</i>	12	40	304.79	59.52
<i>Caboosc</i>	15	45	380.99	66.96	<i>Calefurn</i>	12	35	304.79	52.08
<i>Caburt</i>	15	40	380.99	59.52	<i>Calends</i>	12	30	304.79	44.64
<i>Cachery</i>	15	35	380.99	52.08	<i>Calf</i>	12	25	304.79	37.20

Steel Channels—Continued.

Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.	Code Word.	Depth in inches.	Weight per foot in pounds.	Depth in milli- metres.	Weight per metre in kilograms.
<i>Calker</i>	12	20.5	304.79	30.50	<i>Card</i>	7	14.75	177.79	21.94
<i>Calling</i>	10	35	253.99	52.08	<i>Carder</i>	7	12.25	177.79	18.22
<i>Camel</i>	10	30	253.99	44.64	<i>Caress</i>	7	9.75	177.79	14.50
<i>Camphoring</i>	10	25	253.99	37.20	<i>Cargo</i>	6	15.50	152.39	23.06
<i>Candidly</i>	10	20	253.99	29.76	<i>Carmot</i>	6	13	152.39	19.34
<i>Candle</i>	10	15	253.99	22.32	<i>Carnai</i>	6	10.50	152.39	15.62
<i>Cankorous</i>	9	25	228.59	37.20	<i>Carnalist</i>	6	8	152.39	11.9
<i>Canopy</i>	9	20	228.59	29.76	<i>Carnally</i>	5	11.5	126.99	17.11
<i>Canorosity</i>	9	15	228.59	22.32	<i>Carp</i>	5	9	126.99	13.39
<i>Canton</i>	9	13.25	228.59	19.71	<i>Carpet</i>	5	6.5	126.99	9.67
<i>Cap</i>	8	21.25	203.19	31.62	<i>Carry</i>	4	7.25	101.59	10.78
<i>Capable</i>	8	18.75	203.19	27.90	<i>Carrot</i>	4	6.25	101.59	9.30
<i>Capsize</i>	8	16.25	203.19	24.18	<i>Cartage</i>	4	5.25	101.59	7.81
<i>Capstan</i>	8	13.75	203.19	20.46	<i>Cartridge</i>	3	6	76.19	8.92
<i>Captain</i>	8	11.25	203.19	16.75	<i>Case</i>	3	5	76.19	7.44
<i>Capturyst</i>	7	19.75	177.79	29.39	<i>Caseharden</i>	3	4	76.19	5.95
<i>Carafe</i>	7	17.25	177.79	25.67					

Steel Tees.

EQUAL LEGS.

Code Word.	Size in inches.	Size in millimetres.
<i>Tabid</i>	4 x 4	101.59 x 101.59
<i>Tableau</i>	3½ x 3½	88.89 x 88.89
<i>Tackling</i>	3 x 3	76.19 x 76.19
<i>Tactics</i>	2½ x 2½	63.49 x 63.49
<i>Taffrail</i>	2¼ x 2¼	57.14 x 57.14
<i>Taint</i>	2 x 2	50.79 x 50.79
<i>Tale</i>	1¾ x 1¾	44.44 x 44.44
<i>Talent</i>	1½ x 1½	38.09 x 38.09
<i>Tallow</i>	1¼ x 1¼	31.70 x 31.70
<i>Tallyman</i>	1 x 1	25.40 x 25.40

UNEQUAL LEGS.

Code Word.	Size in inches.	Size in millimetres.
<i>Tamper</i>	4 x 5	101.59 x 126.99
<i>Tampion</i>	4 x 3	101.59 x 76.19
<i>Tan</i>	3½ x 4	88.89 x 101.59
<i>Tapioca</i>	3½ x 3	88.89 x 76.19
<i>Taproom</i>	3 x 4	76.19 x 101.59
<i>Tariff</i>	3 x 2½	76.19 x 63.49
<i>Tarish</i>	3 x 3½	76.19 x 88.89
<i>Tarpaulin</i>	2½ x 3	63.49 x 76.19
<i>Tarry</i>	2½ x 2¾	63.49 x 69.84
<i>Tassel</i>	1¾ x 1¼	44.44 x 31.74

See table for thickness farther on.

Words for Ordering Flats and Plates.

Sizes one inch and under use words given in table farther on headed "Thickness of Metal."

WIDTHS.			WIDTHS.			WIDTHS.			WIDTHS.		
Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.
<i>Wade</i>	1⅛ ..	28.56	<i>Waive</i>	2¼ ..	57.14	<i>Wanness</i>	3¾ ..	95.24	<i>Watch</i>	7 ..	177.79
<i>Waft</i>	1¼ ..	31.74	<i>Wall</i>	2½ ..	63.49	<i>Warehouse</i>	4 ..	101.59	<i>Watcher</i>	8 ..	203.19
<i>Wages</i>	1½ ..	38.09	<i>Walleye</i>	2¾ ..	69.84	<i>Wares</i>	4¼ ..	107.94	<i>Water</i>	9 ..	228.59
<i>Wagon</i>	1⅝ ..	41.27	<i>Wallop</i>	3 ..	76.19	<i>Warm</i>	4½ ..	114.29	<i>Watermelon</i>	10 ..	253.99
<i>Wain</i>	1¾ ..	44.44	<i>Wampum</i>	3¼ ..	82.54	<i>Warranty</i>	5 ..	126.99	<i>Waver</i>	11 ..	279.39
<i>Waist</i>	2 ..	50.79	<i>Wan</i>	3½ ..	88.89	<i>Wash</i>	6 ..	152.39	<i>Weaken</i>	12 ..	304.79

Words for Ordering Flats and Plates—Continued.

WIDTHS.			WIDTHS.			WIDTHS.			WIDTHS.		
Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.	Code Word.	Inches.	Milli- metres.
<i>Wealth</i>	13	.. 330.19	<i>Wellbeing</i>	19	.. 482.59	<i>Wharf</i>	30	.. 761.98	<i>Whinny</i>	60	.. 1523.97
<i>Weasand</i>	14	.. 355.59	<i>Westerly</i>	20	.. 507.99	<i>Wharfage</i>	35	.. 888.98	<i>Whiten</i>	66	.. 1676.37
<i>Weather</i>	15	.. 380.99	<i>Westward</i>	21	.. 532.38	<i>Whatsoever</i>	40	.. 1015.98	<i>Wholesale</i>	72	.. 1828.77
<i>Weed</i>	16	.. 406.39	<i>Westy</i>	22	.. 558.79	<i>Whenever</i>	45	.. 1142.98	<i>Wider</i>	78	.. 1981.16
<i>Weekday</i>	17	.. 431.79	<i>Wex</i>	23	.. 584.18	<i>Whereat</i>	50	.. 1269.97	<i>Widespread</i>	84	.. 2133.56
<i>Weigh</i>	18	.. 457.19	<i>Whaleman</i>	24	.. 609.58	<i>Wherefore</i>	55	.. 1396.97			

Round and Square Steel Bars.

Code Word.	Code Word.	Size in inches.		Size in millimetres.		Code Word.	Code Word.	Size in inches.		Size in millimetres.	
Rounds.	Squares.					Rounds.	Squares.				
<i>Raccoon</i>	<i>Sachem</i>	$\frac{3}{8}$	.....	9.52		<i>Ransomer</i>	<i>Saltpetre</i>	1 3-16	.....	30.15	
<i>Radial</i>	<i>Sage</i>	7-16	.....	11.11		<i>Ransomless</i>	<i>Same</i>	1 $\frac{1}{4}$	.....	31.74	
<i>Radiator</i>	<i>Sagittal</i>	$\frac{1}{2}$	.....	12.69		<i>Rap</i>		1 5-16	.....	33.32	
<i>Radix</i>	<i>Sailloft</i>	9-16	.....	14.28		<i>Rapidly</i>	<i>Sanhedrin</i>	1 $\frac{3}{8}$	.....	34.91	
<i>Raging</i>	<i>Sailor</i>	$\frac{5}{8}$	.....	15.87		<i>Rapine</i>		1 7-16	.....	36.50	
<i>Rags</i>	<i>Sake</i>	11-16	.....	17.46		<i>Rasure</i>	<i>Sapor</i>	1 $\frac{1}{2}$	.....	38.09	
<i>Railway</i>	<i>Salaccous</i>	$\frac{3}{4}$	.....	19.04		<i>Ratan</i>		1 $\frac{5}{8}$	.....	41.27	
<i>Raimbolt</i>	<i>Salamagen</i>	13-16	.....	20.63		<i>Rate</i>	<i>Saporific</i>	1 $\frac{3}{4}$	.....	44.44	
<i>Raise</i>	<i>Salcable</i>	$\frac{7}{8}$	.....	22.22		<i>Rather</i>		1 $\frac{7}{8}$	.....	47.62	
<i>Rake</i>	<i>Sallow</i>	15-16	.....	23.80		<i>Ratling</i>	<i>Saturn</i>	2	.....	50.79	
<i>Rammer</i>	<i>Salt</i>	1	.....	25.39		<i>Ratoon</i>	<i>Saturine</i>	2 $\frac{1}{8}$	.....	53.97	
<i>Ramons</i>	<i>Saltern</i>	1 $\frac{1}{8}$	.....	28.56		<i>Raucity</i>	<i>Savable</i>	2 $\frac{1}{4}$	.....	57.14	

Round and Square Steel Bars—Continued.

Code Word.	Code Word.	Size in inches.	Size in millimetres.
Rounds.	Squares.		
<i>Ravesty</i>	<i>Scannel</i>	2 ³ / ₈	60.32
<i>Ravish</i>	<i>Scanron</i>	2 ¹ / ₂	63.49
<i>Ravishment</i>	<i>Scarce</i>	2 ⁵ / ₈	66.67
<i>Rawhead</i>	<i>Schemer</i>	2 ³ / ₄	69.84
<i>Razor</i>	<i>Schoolman</i>	2 ⁷ / ₈	73.02
<i>Reaction</i>	<i>Schooner</i>	3	76.19
<i>Readily</i>		3 ¹ / ₈	79.37
<i>Readjust</i>	<i>Scraggy</i>	3 ¹ / ₄	82.54
<i>Readmit</i>		3 ³ / ₈	85.72
<i>Reannex</i>	<i>Scrutoir</i>	3 ¹ / ₂	88.89
<i>Reappoint</i>		3 ⁵ / ₈	92.07
<i>Rearguard</i>	<i>Scupper</i>	3 ³ / ₄	95.24
<i>Rcason</i>		3 ⁷ / ₈	98.42
<i>Reasonable</i>	<i>Secederal</i>	4	101.59
<i>Reassert</i>		4 ¹ / ₈	104.77

Code Word.	Code Word.	Size in inches.	Size in millimetres.
Rounds.	Squares.		
<i>Reassign</i>	<i>Seclant</i>	4 ¹ / ₄	107.94
<i>Reassure</i>		4 ³ / ₈	111.12
<i>Rebaptist</i>	<i>Secmart</i>	4 ¹ / ₂	114.29
<i>Rebel</i>		4 ⁷ / ₈	117.47
<i>Rebellion</i>	<i>Second</i>	4 ³ / ₄	120.64
<i>Recapture</i>		4 ⁷ / ₈	123.82
<i>Receivable</i>		5	126.99
<i>Receiver</i>		5 ¹ / ₄	133.34
<i>Recency</i>		5 ¹ / ₂	139.69
<i>Recentness</i>		5 ³ / ₄	146.04
<i>Recheat</i>		6	152.39
<i>Rechoose</i>		6 ¹ / ₄	158.74
<i>Recognize</i>		6 ¹ / ₂	165.09
<i>Recollect</i>		6 ³ / ₄	171.44

Length in Feet.

Code Word.		Code Word.		Code Word.		Code Word.	
<i>Facet</i>	1	<i>Fagend</i>	6	<i>Faldstool</i>	11	<i>Family</i>	16
<i>Facing</i>	2	<i>Failure</i>	7	<i>Fall</i>	12	<i>Famine</i>	17
<i>Facsimile</i>	3	<i>Faintish</i>	8	<i>Falsely</i>	13	<i>Fan</i>	18
<i>Fact *</i>	4	<i>Fair</i>	9	<i>Falter</i>	14	<i>Fancy</i>	19
<i>Factionist</i>	5	<i>Faith</i>	10	<i>Famed</i>	15	<i>Fang</i>	20
						<i>Fangless</i>	21
						<i>Farc</i>	22
						<i>Faring</i>	23
						<i>Farmer</i>	24
						<i>Farrago</i>	25

Length in Feet—Continued.

Code Word.		Code Word.		Code Word.		Code Word.		Code Word.	
<i>Farrier</i>	26	<i>Fathomless</i>	36	<i>Felony</i>	46	<i>Fewness</i>	55	<i>Filings</i>	64
<i>Farrow</i>	27	<i>Fatness</i>	37	<i>Fencing</i>	47	<i>Fiat</i>	56	<i>Filthily</i>	65
<i>Farthing</i>	28	<i>Faulty</i>	38	<i>Fenian</i>	48	<i>Fibber</i>	57	<i>Financier</i>	66
<i>Fascicular</i>	29	<i>Fauny</i>	39	<i>Ferocious</i>	49	<i>Fieriness</i>	58	<i>Fineness</i>	67
<i>Fascinity</i>	30	<i>Favor</i>	40	<i>Fertile</i>	50	<i>Fifer</i>	59	<i>Finisher</i>	68
<i>Fastday</i>	31	<i>Favorable</i>	41	<i>Fervency</i>	51	<i>Figilate</i>	60	<i>Fireclock</i>	69
<i>Fasten</i>	32	<i>Fearful</i>	42	<i>Fervidly</i>	52	<i>Figment</i>	61	<i>Firmly</i>	70
<i>Fatal</i>	33	<i>Feastful</i>	43	<i>Fetid</i>	53	<i>Filiation</i>	62	<i>Firmness</i>	71
<i>Fated</i>	34	<i>Fedition</i>	44	<i>Feudalism</i>	54	<i>Filigree</i>	63	<i>Fishing</i>	72
<i>Fathom</i>	35	<i>Feeder</i>	45						

Length in Inches.

<i>Ibex</i>	$\frac{1}{8}$	<i>Imaginable</i>	$1\frac{1}{2}$	<i>Implacable</i>	$2\frac{7}{8}$	<i>Improbable</i>	$4\frac{1}{4}$	<i>Incisure</i>	$5\frac{5}{8}$
<i>Iceberg</i>	$\frac{1}{4}$	<i>Imagine</i>	$1\frac{5}{8}$	<i>Implcad</i>	3	<i>Improper</i>	$4\frac{3}{8}$	<i>Incitant</i>	$5\frac{3}{4}$
<i>Iceiness</i>	$\frac{3}{8}$	<i>Imbosom</i>	$1\frac{3}{4}$	<i>Implex</i>	$3\frac{1}{8}$	<i>Improve</i>	$4\frac{1}{2}$	<i>Incite</i>	$5\frac{7}{8}$
<i>Ignescent</i>	$\frac{1}{2}$	<i>Immaterial</i>	$1\frac{7}{8}$	<i>Implicit</i>	$3\frac{1}{4}$	<i>Impure</i>	$4\frac{5}{8}$	<i>Inclasp</i>	6
<i>Igniferous</i>	$\frac{5}{8}$	<i>Immigrate</i>	2	<i>Impolite</i>	$3\frac{3}{8}$	<i>Impurity</i>	$4\frac{3}{4}$	<i>Inclose</i>	$6\frac{1}{8}$
<i>Illiberal</i>	$\frac{3}{4}$	<i>Immoderate</i>	$2\frac{1}{8}$	<i>Imporous</i>	$3\frac{1}{2}$	<i>Inaction</i>	$4\frac{7}{8}$	<i>Inclusion</i>	$6\frac{1}{4}$
<i>Illicit</i>	$\frac{7}{8}$	<i>Immovable</i>	$2\frac{1}{4}$	<i>Import</i>	$3\frac{5}{8}$	<i>Inadequate</i>	5	<i>Income</i>	$6\frac{3}{8}$
<i>Illnature</i>	1	<i>Impanel</i>	$2\frac{3}{8}$	<i>Impregnate</i>	$3\frac{3}{4}$	<i>Inane</i>	$5\frac{1}{8}$	<i>Incurious</i>	$6\frac{1}{2}$
<i>Illogical</i>	$1\frac{1}{8}$	<i>Impassive</i>	$2\frac{1}{2}$	<i>Imprimis</i>	$3\frac{7}{8}$	<i>Inaposite</i>	$5\frac{1}{4}$	<i>Indecent</i>	$6\frac{5}{8}$
<i>Illstarred</i>	$1\frac{1}{4}$	<i>Impawn</i>	$2\frac{5}{8}$	<i>Imprint</i>	4	<i>Inapt</i>	$5\frac{3}{8}$	<i>Indeed</i>	$6\frac{3}{4}$
<i>Illwill</i>	$1\frac{3}{8}$	<i>Impersonal</i>	$2\frac{3}{4}$	<i>Imprison</i>	$4\frac{1}{8}$	<i>Inarch</i>	$5\frac{1}{2}$	<i>Index</i>	$6\frac{7}{8}$

Length in Inches—Continued.

Code Word.		Code Word.		Code Word.		Code Word.		Code Word.	
<i>Indian</i>	7	<i>Inertia</i>	8 $\frac{1}{8}$	<i>Infold</i>	9 $\frac{1}{8}$	<i>Inkiness</i>	10 $\frac{1}{8}$	<i>Insnare</i>	11 $\frac{1}{8}$
<i>Indicate</i>	7 $\frac{1}{8}$	<i>Inertness</i>	8 $\frac{1}{4}$	<i>Inform</i>	9 $\frac{1}{4}$	<i>Inland</i>	10 $\frac{1}{4}$	<i>Insolvent</i>	11 $\frac{1}{4}$
<i>Indorse</i>	7 $\frac{1}{4}$	<i>Infamy</i>	8 $\frac{3}{8}$	<i>Infuse</i>	9 $\frac{3}{8}$	<i>Inlet</i>	10 $\frac{3}{8}$	<i>Inspire</i>	11 $\frac{3}{8}$
<i>Indue</i>	7 $\frac{3}{8}$	<i>Infant</i>	8 $\frac{1}{2}$	<i>Ingot</i>	9 $\frac{1}{2}$	<i>Inmost</i>	10 $\frac{1}{2}$	<i>Instance</i>	11 $\frac{1}{2}$
<i>Incubate</i>	7 $\frac{1}{2}$	<i>Infer</i>	8 $\frac{5}{8}$	<i>Ingulf</i>	9 $\frac{5}{8}$	<i>Inning</i>	10 $\frac{5}{8}$	<i>Instead</i>	11 $\frac{5}{8}$
<i>Inedited</i>	7 $\frac{5}{8}$	<i>Inferior</i>	8 $\frac{3}{4}$	<i>Inhere</i>	9 $\frac{3}{4}$	<i>Insecure</i>	10 $\frac{3}{4}$	<i>Insurable</i>	11 $\frac{3}{4}$
<i>Ineffective</i>	7 $\frac{3}{4}$	<i>Infernal</i>	8 $\frac{7}{8}$	<i>Injure</i>	9 $\frac{7}{8}$	<i>Inside</i>	10 $\frac{7}{8}$	<i>Insurance</i>	11 $\frac{7}{8}$
<i>Ineligible</i>	7 $\frac{7}{8}$	<i>Infix</i>	9	<i>Ink</i>	10	<i>Insist</i>	11	<i>Insure</i>	12
<i>Inequality</i>	8								

Length in Metres.

<i>Machinery</i>	1	<i>Makebate</i>	7	<i>Manifest</i>	13	<i>Maranatha</i>	19	<i>Marshy</i>	25
<i>Madrepore</i>	2	<i>Mallard</i>	8	<i>Manlike</i>	14	<i>Marcid</i>	20	<i>Martinman</i>	26
<i>Magi</i>	3	<i>Mallozes</i>	9	<i>Mantua</i>	15	<i>Marital</i>	21	<i>Masonic</i>	27
<i>Mahogany</i>	4	<i>Malmsey</i>	10	<i>Manurial</i>	16	<i>Marlant</i>	22	<i>Mayday</i>	28
<i>Mainmast</i>	5	<i>Manage</i>	11	<i>Maple</i>	17	<i>Marline</i>	23	<i>Mazarine</i>	29
<i>Major</i>	6	<i>Mangle</i>	12	<i>Mappery</i>	18	<i>Marmorean</i>	24	<i>Meaning</i>	30

Decimal Parts of a Metre.

Code Word		Code Word.		Code Word.		Code Word.		Code Word.	
<i>Measly</i>	.100	<i>Mediation</i>	.700	<i>Melody</i>	.040	<i>Mend</i>	.090	<i>Mesh</i>	.005
<i>Measure</i>	.200	<i>Mediator</i>	.800	<i>Melon</i>	.050	<i>Menhaden</i>	.001	<i>Methodical</i>	.006
<i>Meat</i>	.300	<i>Mced</i>	.900	<i>Memorable</i>	.060	<i>Merchant</i>	.002	<i>Metropolis</i>	.007
<i>Mechanism</i>	.400	<i>Melee</i>	.010	<i>Memorandum</i>	.070	<i>Mercy</i>	.003	<i>Mew</i>	.008
<i>Meckanist</i>	.500	<i>Melodeon</i>	.020	<i>Memorize</i>	.080	<i>Merriest</i>	.004	<i>Mezzo</i>	.009
<i>Medal</i>	.600	<i>Melodrama</i>	.030						

Thickness of Metal.

	In inches.	In milli-metres.		In inches.	In milli-metres.		In inches.	In milli-metres.
<i>Earnings</i>	$\frac{1}{8}$	3.17	<i>Eaves</i>	7-16	11.11	<i>Edyction</i>	$\frac{3}{4}$	19.05
<i>Earthtank</i>	3-16	4.76	<i>Ebriation</i>	$\frac{1}{2}$	12.7	<i>Effective</i>	13-16	20.63
<i>Eastern</i>	$\frac{1}{4}$	6.34	<i>Edgeman</i>	9-16	14.28	<i>Effectual</i>	$\frac{7}{8}$	22.22
<i>Eastward</i>	5-16	7.93	<i>Edging</i>	$\frac{5}{8}$	15.87	<i>Egression</i>	15-16	23.81
<i>Easy</i>	$\frac{3}{8}$	9.52	<i>Edomant</i>	11-16	17.46	<i>Egrette</i>	10-0	25.4

For Weights in Pounds and Decimal Parts of a Pound only.

Code Word.		Code Word.		Code Word.		Code Word.		Code Word.	
<i>Habeas</i>	1.00	<i>Hair</i>	7.00	<i>Handbill</i>	.30	<i>Hardhack</i>	.90	<i>Harrow</i>	.05
<i>Habitable</i>	2.00	<i>Hallow</i>	8.00	<i>Handcuff</i>	.40	<i>Hardy</i>	.01	<i>Harvest</i>	.06
<i>Habitual</i>	3.00	<i>Halo</i>	9.00	<i>Handier</i>	.50	<i>Harmonica</i>	.02	<i>Hash</i>	.07
<i>Hades</i>	4.00	<i>Halter</i>	0.00	<i>Hank</i>	.60	<i>Harmonious</i>	.03	<i>Haste</i>	.08
<i>Haft</i>	5.00	<i>Halyard</i>	.10	<i>Happier</i>	.70	<i>Harness</i>	.04	<i>Hatchet</i>	.09
<i>Hail</i>	6.00	<i>Hammock</i>	.20	<i>Harbor</i>	.80				

For Weights in Kilograms and Decimal Parts of a Kilogram only.

<i>Hatchway</i>	1.00	<i>Hawker</i>	7.00	<i>Headway</i>	.30	<i>Heath</i>	.90	<i>Heirloom</i>	.05
<i>Hatter</i>	2.00	<i>Hazardous</i>	8.00	<i>Healthily</i>	.40	<i>Hector</i>	.01	<i>Helter</i>	.06
<i>Haunch</i>	3.00	<i>Hazel</i>	9.00	<i>Healthier</i>	.50	<i>Hedgehog</i>	.02	<i>Hemstich</i>	.07
<i>Hauteur</i>	4.00	<i>Headstall</i>	0.00	<i>Hearsay</i>	.60	<i>Heifer</i>	.03	<i>Hemlock</i>	.08
<i>Haven</i>	5.00	<i>Headstone</i>	.10	<i>Hearse</i>	.70	<i>Heinous</i>	.04	<i>Henceforth</i>	.09
<i>Havoc</i>	6.00	<i>Headstrong</i>	.20	<i>Hearless</i>	.80				

Prices—U. S. A.

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Pacha</i>	1-10 .....	.22
<i>Package</i>	$\frac{1}{8}$ .....	.275
<i>Palatine</i>	2-10 .....	.44
<i>Palliasse</i>	$\frac{1}{4}$ .....	.55
<i>Pallid</i>	3-10 .....	.66
<i>Pandect</i>	$\frac{3}{8}$ .....	.825
<i>Pantalets</i>	4-10 .....	.88
<i>Pantaloons</i>	$\frac{1}{2}$	1.10
<i>Fantheist</i>	6-10	1.32
<i>Panther</i>	$\frac{5}{8}$	1.375
<i>Papacy</i>	7-10	1.54
<i>Papyrus</i>	$\frac{3}{4}$	1.65
<i>Paradise</i>	8-10	1.76
<i>Parallax</i>	$\frac{7}{8}$	1.925
<i>Parasol</i>	9-10	1.98
<i>Parcel</i>	1	2.2
<i>Parentless</i>	1 1-10	2.42
<i>Parliament</i>	1 $\frac{1}{8}$	2.475
<i>Passbook</i>	1 2-10	2.64
<i>Passenger</i>	1 $\frac{1}{4}$	2.75
<i>Passport</i>	1 3-10	2.86
<i>Payable</i>	1 $\frac{3}{8}$	3.025

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Payment</i>	1 4-10	3.08
<i>Peace</i>	1 $\frac{1}{2}$	3.30
<i>Pegasus</i>	1 6-10	3.52
<i>Pelicle</i>	1 $\frac{5}{8}$	3.575
<i>Pelisse</i>	1 7-10	3.74
<i>Penknife</i>	1 $\frac{3}{4}$	3.85
<i>Pentagraph</i>	1 8-10	3.96
<i>Peony</i>	1 $\frac{7}{8}$	4.125
<i>Percentage</i>	1 9-10	4.18
<i>Perhaps</i>	2	4.4
<i>Periman</i>	2.05	4.51
<i>Peristyle</i>	2 1-10	4.62
<i>Perjure</i>	2 $\frac{1}{8}$	4.675
<i>Petition</i>	2.15	4.73
<i>Petroleum</i>	2 2-10	4.84
<i>Phaeton</i>	2.25	4.95
<i>Pharisee</i>	2 3-10	5.06
<i>Philippic</i>	2.35	5.17
<i>Philomel</i>	2 $\frac{3}{8}$	5.225
<i>Phosphoric</i>	2 4-10	5.28
<i>Photogen</i>	2.45	5.39
<i>Piantic</i>	2 $\frac{1}{2}$	5.5

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Pickpocket</i>	2.55	5.61
<i>Pilot</i>	2 6-10	5.72
<i>Pilotage</i>	2 $\frac{5}{8}$	5.775
<i>Pinch</i>	2.65	5.83
<i>Pine</i>	2 7-10	5.94
<i>Pirate</i>	2 $\frac{3}{4}$	6.05
<i>Piratical</i>	2 8-10	6.16
<i>Pitchpipe</i>	2.85	6.27
<i>Pitiless</i>	2 $\frac{7}{8}$	6.325
<i>Placeman</i>	2 9-10	6.38
<i>Plague</i>	2.95	6.49
<i>Plainly</i>	3	6.6
<i>Plaintiff</i>	3.05	6.71
<i>Plan</i>	3 1-10	6.82
<i>Plantain</i>	3 $\frac{1}{8}$	6.875
<i>Planticle</i>	3.15	6.93
<i>Plasmatic</i>	3 2-10	7.04
<i>Plateau</i>	3.25	7.15
<i>Platitude</i>	3 3-10	7.26
<i>Platonic</i>	3.35	7.37
<i>Platter</i>	3 $\frac{3}{8}$	7.425
<i>Playfellow</i>	3 4-10	7.48

Prices—U. S A.—Continued.

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Pleconastic</i>	3.45	7.59
<i>Plexiform</i>	3½	7.7
<i>Plinth</i>	3.55	7.81
<i>Ploughman</i>	3 6-10	7.92
<i>Plumblinc</i>	3⅝	7.975
<i>Plumiped</i>	3.65	8.03
<i>Plural</i>	3 7-10	8.14
<i>Plush</i>	3¾	8.25
<i>Plutonian</i>	3 8-10	8.36
<i>Pluvial</i>	3.85	8.47
<i>Pneumonia</i>	3⅞	8.525
<i>Podag</i>	3 9-10	8.58
<i>Podded</i>	3.95	8.69
<i>Poise</i>	4	8.8
<i>Polemic</i>	4.05	8.91
<i>Police</i>	4 1-10	9.02
<i>Politican</i>	4⅛	9.075
<i>Pollard</i>	4.15	9.13
<i>Polyhedron</i>	4 7-10	9.24
<i>Polyfus</i>	4.25	9.35
<i>Pomatium</i>	4 3-10	9.46
<i>Pomology</i>	4.35	9.57

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Pomp</i>	4⅜	9.625
<i>Ponder</i>	4 4-10	9.68
<i>Pony</i>	4.45	9.79
<i>Popish</i>	4½	9.9
<i>Poplin</i>	4.55	10.01
<i>Poppy</i>	4 6-10	10.12
<i>Population</i>	4⅝	10.175
<i>Populous</i>	4.65	10.23
<i>Porch</i>	4 7-10	10.34
<i>Porker</i>	4¾	10.45
<i>Poringcr</i>	4 8-10	10.56
<i>Porosity</i>	4.85	10.67
<i>Porter</i>	4⅞	10.725
<i>Porterage</i>	4 9-10	10.78
<i>Porthole</i>	4.95	10.89
<i>Portion</i>	5	11.
<i>Poscr</i>	5.05	11.11
<i>Position</i>	5 1-10	11.22
<i>Positively</i>	5⅛	11.275
<i>Possible</i>	5.15	11.33
<i>Postage</i>	5 2-10	11.44
<i>Posterity</i>	5.25	11.55

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Postmark</i>	5 3-10	11.66
<i>Postpone</i>	5.35	11.77
<i>Potash</i>	5⅜	11.825
<i>Pratigue</i>	5 4-10	11.88
<i>Prayerless</i>	5.45	11.99
<i>Precaution</i>	5½	12.1
<i>Preclusion</i>	5.55	12.21
<i>Predaceous</i>	5 6-10	12.32
<i>Predality</i>	5⅝	12.375
<i>Preference</i>	5.65	12.43
<i>Prefigure</i>	5 7-10	12.54
<i>Prehensible</i>	5¾	12.65
<i>Prelatical</i>	5 8-10	12.76
<i>Prelatist</i>	5.85	12.87
<i>Prelude</i>	5⅞	12.925
<i>Premature</i>	5 9-10	12.98
<i>Premier</i>	5.95	13.09
<i>Premium</i>	6	13.2
<i>Preoccupy</i>	6.05	13.31
<i>Prepaid</i>	6 1-10	13.42
<i>Prepossess</i>	6⅛	13.475
<i>Pressing</i>	6.15	13.53

Prices—U. S. A.—Continued.

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Pressure</i>	6 2-10	13.64
<i>Prevention</i>	6 ¼	13.75
<i>Preventive</i>	6 3-10	13.86
<i>Previous</i>	6.35	13.97
<i>Previously</i>	6 ¾	14.025
<i>Prick</i>	6 4-10	14.08
<i>Prickling</i>	6.45	14.19
<i>Priestly</i>	6 ½	14.30
<i>Prim</i>	6.55	14.41
<i>Primarily</i>	6 6-10	14.52

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Primordial</i>	6 ⅝	14.575
<i>Princely</i>	6.65	14.63
<i>Prism</i>	6 7-10	14.74
<i>Prisoner</i>	6 ¾	14.85
<i>Privateer</i>	6 8-10	14.96
<i>Privately</i>	6.85	15.07
<i>Privative</i>	6 ⅞	15.125
<i>Probably</i>	6 9-10	15.18
<i>Proceeds</i>	6.95	15.29

Code Word.	Price per pound in cents.	Price per kilo in cents.
<i>Procreate</i>	7	15.40
<i>Procurable</i>	7 ⅛	15.675
<i>Prodigious</i>	7 ¼	15.95
<i>Produce</i>	7 ⅜	16.225
<i>Profession</i>	7 ½	16.5
<i>Profitable</i>	7 ⅝	16.775
<i>Profitless</i>	7 ¾	17.05
<i>Prognostic</i>	7 ⅞	17.325
<i>Prone</i>	8	17.6

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